

# HIGH RELIABILITY MULTI-LAYER CERAMIC EMI FILTERS



A SUBSIDIARY OF AVX CORPORATION

STANDARD  
SEMI-CUSTOM  
CUSTOM



# From the Beginning to the End—Quality and Reliability

## INSERTION LOSS TESTING TO 10GHz



## QUALIFICATION TESTING



AVX Filters is the recognized leader in the design and manufacture of high reliability filters for military, space, medical, and other high technology applications.

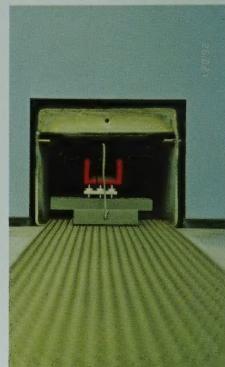
Located in Sun Valley, California, AVX Filters enjoys a respected position in the industry through innovations such as

- Qualification to MIL-F-28861
- A fully baselined manufacturing facility complying with MIL-STD-790 with manufacturing capability to MIL-F-28861 Class S
- DESC approved environmental test lab
- Integration of SQC and SPC
- New product development capability on site with extensive corporate accessibility
- A leader in custom and semi-custom designs.

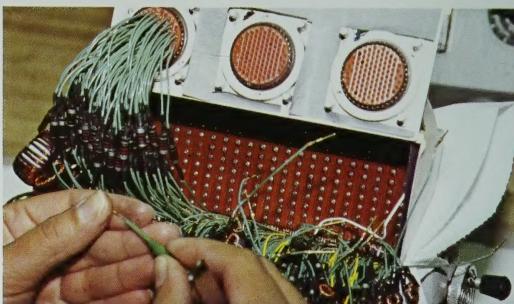
## AUTOMATED TESTING



## MICROPROCESSOR CONTROLLED PROCESSING



## MULTICIRCUIT ASSEMBLY



## CLEAN ROOM ASSEMBLY



## NEW HERMETIC SOLDER-IN



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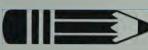
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# GENERAL



**Introduction**



# INTRODUCTION

## HIGH-REL EMI FILTERS

Noise is the enemy of good engineering design. Properly installed EMI filters suppress such electromagnetic interference on power and signal lines, while allowing desired signals to pass. For critical EMI filter applications, high reliability is of the utmost importance.

High reliability applications have diverse requirements, ranging from a need for a long operating life in medical or military systems to avoiding the prohibitive cost of replacing a faulty component in a satellite, undersea cable, or other inaccessible system. High-rel filters satisfy application-critical requirements in many environments:

- Space/Satellite Systems
- Military Aircraft
- Guidance Systems
- Command, Control & Communications (C<sup>3</sup>)
- Missile Systems
- Weapon Systems
- Radar Systems
- Electro Optical Systems
- Electronic Countermeasures
- Electronic Warfare
- Pacemakers
- Medication Monitors

## HIGH-REL STANDARDS

Reliability must be designed into an EMI filter. Every step in its manufacture from material selection through testing and characterization must be considered. To assure conformance to clearly-defined product and performance parameters, specifications have evolved for electrical performance, mechanical configurations, test methods, screening and qualification procedures.

AVX Filters delivers high quality EMI filters which meet applicable portions of these high-reliability standards:

- MIL-F-15733
- MIL-STD-220
- MIL-F-28861
- MIL-Q-9858
- MIL-STD-202
- NASA NHB 5300
- MIL-I-45208A

- MIL-STD-790
- MIL-C-123
- ISO 9000
- MIL-STD-1547
- EIA-RS-469

## AVX FILTERS AT THE LEADING EDGE

AVX Filters Corporation continues to provide innovative solutions to the high performance needs of its customers. It has pioneered many breakthroughs which have advanced the state-of-the-art in this demanding discipline, including:

- The first to qualify to the new High-Reliability Filter Spec, MIL-F-28861.
- Facility qualified to MIL-STD-790 during first round of audits for filter manufacturers.
- The first solder-in filter line to offer 400°C installation temperature.
- The first filter line designed to meet the new MIL-Spec requirements for heat rise/reactive current in 125 VAC and 230 VAC 400 Hz applications.
- The first to offer a filter line of hermetically sealed bolt style filters.

## CUSTOM AND SEMI-CUSTOM

In addition to standard catalog and QPL EMI filters, AVX Filters produces two classes of these special products: Semi-custom and Custom. Semi-custom involves variations in electrical parameters, testing, and limited mechanical changes from standard product designs. Delivery is slightly longer and price is slightly higher than standard products.

Custom products require longer lead time for design and manufacturing, but give designers freedom to specify non-standard mechanical and electrical filter designs.

AVX Filters dedicates a unique internal part number to every semi-custom and custom component. This insures continued configuration control for each part, allows future changes to be easily implemented, and provides assurance that the design always matches the customer requirements.

## ENGINEER TO ENGINEER

Our application engineering staff will assist in defining your filter requirements, while recommending advantages, reliability, quality assurance levels, and filter performance at the lowest practical cost. They will help in filter selection and specification, including meeting DESC requirements. SCD models are available to assist you in the design process. A custom filter part number will be assigned exclusively to your SCD. To obtain prompt, professional assistance, call **(818) 767-6770**.

## QUALITY ASSURANCE

Quality assurance is built into every stage of manufacturing and testing. AVX Filters controls the entire process, from the capacitor's dielectric formulation through final filter test. This results in absolute traceability by lot number to a specific dielectric batch, as well as the subsequent materials, equipment and employees involved in the tightly-controlled manufacturing and testing process. In addition, critical processes are monitored using SQC, SPC techniques.

# AVX FILTERS CORPORATION

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## QUALITY VISION STATEMENT

### **QV2000** **The standard of quality excellence**

*QV2000 is a package of management systems improvements intended to build an authentic total quality environment that will delight our customer base over the next decade.*

QV2000 is a comprehensive customer satisfaction initiative developed by AVX to ensure AVXcellence in every aspect of our business. It means Quality Vision 2000 and it will become our guiding light to achieving quality excellence during the months and years ahead.

The quality we talk about in QV2000 means an uncompromising involvement in our work at every level. It offers a sense of pride and ownership we dare to be measured by. It's a commitment we stake our claim to. Quality has made AVX the great company it is today. It is our challenge to get even better during the tougher times ahead.

The number "2000" indicates the scope of our endeavor. QV2000 is not a short-term quick hit plan. It is an all-encompassing initiative that will take a number of years to grow into. It's a plan based on total quality that will guide AVX to the position of industry leader during this decade. QV2000 gives every manager and every employee the additional tools to reach this challenging goal.

This is our AVX Quality Vision promise:

*"During this decade, AVX will be recognized as the premier supplier of electronic components by consistently demonstrating superior performance in quality and service, resulting in total customer satisfaction."*

# FILTER PRODUCT SELECTOR



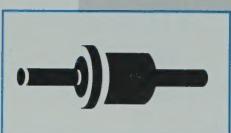
**Filter Styles**

- Solder-In
- Bolt
- Cylindrical
- Brackets
- Multicircuit

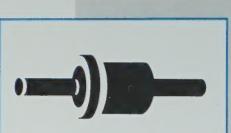
# FILTER PRODUCT SELECTOR



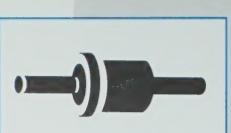
Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Solder-In Hi-Temp Circuits C	ZZ .118 DIA	100 MHz- 26 GHz			50-200 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Solder-In Hi-Temp Circuits C,L	ZS .128 DIA	10 MHz- 26 GHz		28861/12	50-200 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Solder-In Hi-Temp Circuits C,L	YS .165 DIA	1 MHz- 10 GHz		28861/15	50-200 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Solder-In Hi-Temp Circuits C,L	XS .250 DIA	50 KHz- 10 GHz		28861/14	50-300 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Solder-In Hi-Temp Circuits C,L	WS .400 DIA	500 KHz- 10 GHz		28861/13	50-300 VDC 125 VAC 400 Hz

CAP Range	DC Current
25pF-1500pF	5A

#### Application Notes

Hermetically sealed on one end. This series is the smallest diameter solder-in series offered by AVX Filters. The capacitance available is limited due to smaller diameter. Provides effective filtering in the microwave frequency spectrum from 100 MHz through 26 GHz.

CAP Range	DC Current
.01pF-.015 MFD	5A

#### Application Notes

Hermetically sealed on one end. This solder-in series provides both C & L circuit configurations with effective filtering in the microwave frequency spectrum from 10 MHz to 26 GHz. Unique construction provides 300°C installation protection against internal solder reflow. Ideal for assembly into filter arrays.

CAP Range	DC Current
1500pF-.1 MFD	5A

#### Application Notes

Hermetically sealed on one end. This solder-in series provides both C & L circuit configurations with effective filtering in the microwave frequency from 1 MHz to 10 GHz. The larger diameter facilitates the availability of higher cap values. Unique construction provides 300°C installation protection against internal solder reflow. All ratings available. Ideal for assembly into arrays.

CAP Range	DC Current
.01 MFD-.25 MFD	10A

#### Application Notes

Hermetically sealed on one end. This solder-in series provides both C & L circuit configurations with effective filtering in the HF through microwave frequency from 50 KHz to 10 GHz. The larger diameter of the XS provides higher values of capacitance making it ideal for low to medium impedance circuits where larger amounts of capacitance to ground can be tolerated. Unique construction provides 300°C installation protection against internal solder reflow. Ideal for assembly into arrays.

CAP Range	DC Current
.01 MFD-1.2 MFD	15A

#### Application Notes

Hermetically sealed on one end. This solder-in series provides both C & L circuit configurations with corrective filtering in the HF through microwave frequency from 500 KHz to 10 GHz. The larger diameter in the WS series provides higher values of capacitance making it ideal for low to medium impedance circuits where larger amounts of capacitance to ground can be tolerated. Unique construction provides 300°C installation protection against internal solder reflow. All ratings available. Ideal for assembly into arrays.

# FILTER PRODUCT SELECTOR

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Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Bolt Circuits C, L	SA 4-40 Thread	500 KHz-26 GHz		28861/6	50-200 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Bolt Circuits C, L, $\pi$	SB 8-32 Thread	500 KHz-10 GHz		28861/7	50-200 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Bolt Circuits C, L, $\pi$	SH 10-32 Thread	500 KHz-10 GHz			50-200 VDC



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Bolt Circuits C, L, $\pi$	SP 12-32 Thread	500 KHz-10 GHz		28861/9	50-200 VDC 115 VAC 400 Hz



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Bolt Circuits C, $\pi$ Herm Seal	SN 12-32 Thread	1 MHz-10 GHz		28861/10	50-200 VDC 115 VAC 400 Hz



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Cylindrical Epoxy Seal Button Circuits C, L	BL .375 DIA	500 KHz-1 GHz			50-200 VDC 125 VAC 400 Hz



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Cylindrical Herm Seal Button Circuits C, L	BK .375 DIA AK .410 DIA	100 KHz-10 GHz	28861/1	28861/1 15733/38	50-200 VDC 125 VAC 400 Hz

CAP Range	DC Current
1000pF-.05 MFD	5A

#### Application Notes

Smallest size bolt available. Specially effective in RF and microwave frequencies 10 MHz - 26 GHz.

CAP Range	DC Current
1000pF-.05 MFD	10A

#### Application Notes

Most commonly used bolt-style filter provides improved filtering in the HF through microwave frequency spectrum from 1 MHz - 10 GHz.

CAP Range	DC Current
1000pF-.2 MFD	10A

#### Application Notes

Provides intermediate filtering in the RF through microwave frequency spectrum from 100 KHz through 10 GHz.

CAP Range	DC Current
1000pF-.05 MFD	10A

#### Application Notes

Provides increased filtering in the HF through microwave frequency spectrum from 100 KHz to 10 GHz. The larger hex size provides for higher capacitance values and 115 VDC/400 Hz rating. Also available in a slightly smaller hex head configuration. Specify SC Series custom design.

CAP Range	DC Current
1000pF-.2 MFD	10A

#### Application Notes

Hermetically sealed bolt-style filter provides effective filtering from 1 MHz to 10 GHz.

CAP Range	DC Current
.01 MFD-1.4 MFD	15A

#### Application Notes

Highest cap values available in small size - 1.4 MFD. Lowest profile configuration in cylindrical style best suited for low moisture environments where hermetic seal is not required. Provides effective filtering from 500 KHz to 1 GHz.

CAP Range	DC Current
.01 MFD-1.4 MFD	15A

#### Application Notes

Highest cap values available in small size. Herm sealed package 1.4 MFD. Lowest profile configuration in herm sealed cylindrical style.

MIL-F-28861/1 is the QPL equivalent of this configuration offering limited cap values to 1.2 MFD. This series offers effective filtering from 100 KHz to 10 GHz.

# FILTER PRODUCT SELECTOR

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Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Cylindrical Herm Seal Circuits C, L	CK .375 DIA	100 KHz-10 GHz			50-200 VDC 125 VAC 400 Hz



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Cylindrical Herm Seal Circuits L, $\pi$ T, 5 Elemt.	GK .375 DIA HK .410 DIA	30 KHz-10 GHz	28861 /2, /4, /5 15733 /23, /25, /26, /34	28861 /2, /3, /4, /5 15733 /23, /26, /38, /25, /34	50-200 VDC 125 VAC 400 Hz



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Cylindrical Herm Seal Circuits C, L, $\pi$ , T	JD .690 DIA	14 KHz-10 GHz		28861 /16, /17 84083, 84084 15733/34	50-400 VDC 230 VAC 400 Hz

## CUSTOM DESIGNS

### MULTI-COMPONENT BRACKETS



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Brackets	MFB	100 MHz-26 GHz		Brackets could be provided with MIL-F-28861 /12, /13, /14, /15 as available (See QPL Listing)	50-200 VDC

### MULTI-CIRCUIT FILTERS



Filter Style	Series	Filter Frequency Range	AVX QPL	MIL SPEC	Voltage Range
Multicircuit C, L, $\pi$ , T, 2T	MC	14 KHz-1 GHz			50-1000 VDC 125 AC/400 Hz-230 VAC/400 Hz

CAP Range	DC Current
.01 MFD- .4 MFD	15A

#### Application Notes

This hermetically sealed filter is a medium profile design, slightly longer than the BK button series, but shorter than the GK series. It offers effective filtering from 100 KHz to 10 GHz.

CAP Range	DC Current
.15 MFD- .4 MFD	.1-15A
.15 MFD- .9 MFD	.1-15A

#### Application Notes

This hermetically sealed filter series provides the longest cases and most space available in a .375 diameter cylindrical style. It also offers the greatest number of circuit options.

The MIL-F-28861/2, 3, 4, 5 are the QPL equivalents of this series. This series offers effective filtering from 30 KHz to 10 GHz. Available with transient suppression devices to provide EMP and lightning protection.

CAP Range	DC Current
.15 MFD- .36 MFD	.5-15A

#### Application Notes

This hermetically sealed filter series provides a larger diameter (.690 max). Increased length, restricted capacitance and conservative dielectrics makes it ideal for 400 Hz applications where high reactive currents and heat dissipation must be controlled. MIL-F-15733/34 and MIL-F-28861/16 and 17 are the QPL equivalents of this series. DESC 84083, 84084 may be used until qualified sources are available on QPL.

The 230 VAC "T" section design is uniquely capable of handling very high pulse inrush currents or over voltage conditions typical of EMP. Available with transient suppression devices to provide additional EMP and lightning protection. This series offers effective filtering from 14 KHz to 10 GHz.

CAP Range	DC Current
10pF- 1.2 MFD	5-15A

#### Application Notes

This series of custom assemblies utilizes AVX Filters' line of high temperature solder-in filters capable of 300°C or 400°C installation temperature and can be designed and fabricated to your specified requirements or spec control drawings. They can be furnished 100% tested and burned-in prior to shipment. To satisfy your requirements for military QPL product and to preclude the need for non-standard parts approval, these filter arrays may be supplied with MIL-F-28861 /12, /13, /14 or /15 filters installed as available (see QPL Listings). If no QPL sources available, the arrays could be supplied with filters approved to DESC drawings 88010, 84080, 84081, or 84082, respectively, or to the AVX Filters catalog equivalents designed to the requirements of the MIL-F-28861 slash sheets.

CAP Range	DC Current
As required	0-25A

#### Application Notes

AVX Filters can design a specific Multicircuit filter to meet your unique packaging and electrical requirements. Working with our Application Engineering Group you can develop a spec control drawing (SCD) around your specific needs incorporating AVX Filters' considerable filter design experience. In many applications, Multicircuits offer a superior alternative to discrete filters. The custom Multicircuit design many times provides substantial space savings and volumetric efficiency over discrete filter components. In applications where tight packaging is critical, or where unique shapes or sizes are required to fit the system, custom Multicircuit designs are the ideal solution.



# FILTER DESIGN GUIDE



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## Filter Design Guide

- High Reliability Filter
- Inside a High-Rel Filter
- Engineering Design
- Manufacturing Control
- Reliability/Quality Assurance
- Filter Reliability Codes: S, B, R
- Flow Chart—High Reliability Testing
- MIL-F-28861 Screening
- R Level Screening
- DPA and Other Screening Techniques
- Environmental Test Specifications
- Screw and Locking Washer Table
- Filter Types
- Options
- SCD Check List

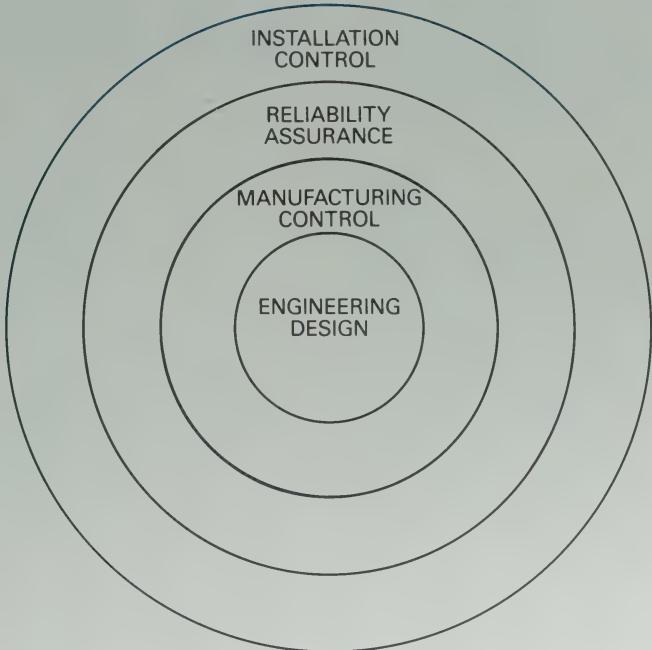


# HIGH RELIABILITY FILTERS

## WHAT IS A HIGH-REL FILTER?

A high reliability EMI filter must deliver consistent performance over a wide range of harsh environmental and electrical conditions. It must incorporate substantial amounts of capacitance and inductance, to provide critical filtering, and rugged enough not to be a potential cause of system failure.

The high-rel filter is the end product of a coordinated effort involving sound engineering design, manufacturing control, reliability assurance, and installation control. Each of these areas is critical to the final result.



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## ENGINEERING DESIGN

High-rel filter design must take into account the worst case conditions of the intended application. A good design should specify filter materials capable of performing over a full range of environmental and electrical conditions. Critical to this reliability is the filter capacitor's ceramic dielectric material, which must perform over a wide temperature and voltage range, while maintaining stable capacitance. The use of military grade stable dielectrics (NPO, BX, X7R) is essential to proper performance.

## MANUFACTURING CONTROL

The entire manufacturing process must be tightly-controlled by order and lot. All the components that go into making up a filter must be

qualified and inspected. All processes, components and materials must be monitored, with full traceability by lot across the entire manufacturing cycle. Manufacturing should be flexible enough to allow additional processes, quality assurance testing, and inspections to be added as needed.

## RELIABILITY ASSURANCE

Reliability can only be accomplished by tightly monitoring quality, the assembly processes, and testing of the filters as they move through the work stations. In-process electrical and mechanical inspection, supplemented by random audits, form the basis for reliability assurance. Stress-to-failure and accelerated environmental testing are also necessary for long-term reliability prediction.

## INSTALLATION CONTROL

Reliability considerations continue long after the component is shipped. It is critical that filters be carefully installed to insure reliable performance. Excessive thermal shock or mechanical stress during installation can destroy parts produced to the highest standards of reliability. Because of this, it is strongly recommended that ceramic EMI filters which are soldered in to subassemblies, boards or housings in your manufacturing process, be submitted to a final 100% screening test to insure the ultimate in reliability. Purchasing a filter module or subassembly which has been 100% tested after filter installation is another alternative. See custom filter array section.

# INSIDE A HIGH-REL FILTER

This cross-section shows a GK7 2T filter with five stages or poles. Like all AVX Filters high-rel products, it uses only monolithic discoidal capacitors utilizing

stable ceramic dielectric material. The finished capacitor is monolithic, meaning that the dielectric

and electrode stack fires together to form a single, solid structure.

## ELECTRICAL CONNECTIONS

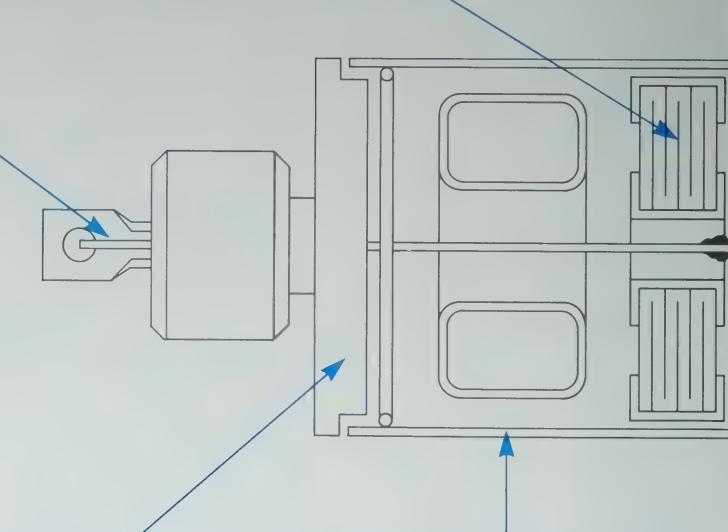
A special high melting point soldered process is used to solder the terminal flags to the filter's internal lead wires. This solder has a 300°C minimum reflow temperature, allowing lead attach soldering to the terminals without causing solder reflow within the filter. Each solder joint is carefully cleaned and inspected to insure that no solder splash or solder silvers are trapped within the unit. A certified in-house X-ray lab is available when specified to inspect the internal construction of the assembled filter.

## CAPACITORS

Discoidal ceramic capacitors have a much lower internal inductance than rectangular chips or leaded devices. When used in a bypass or feedthru filter application, they offer lower impedance-to-ground characteristics than conventional styles, making them a preferred choice in high frequency filter designs.

Discoidal geometry will self-resonate at a much higher frequency than other capacitor shapes. A discoidal capacitor is also unique because it will continue to perform as an effective filter above resonant frequency. Other capacitor types rapidly become inductive above resonance and filtering capability decreases.

EMI filters are conservatively rated; their insertion loss values take into account the internal resonance and temperature drift of the capacitors. AVX Filters uses only EIA military grade stable dielectrics — such as NPO, BX, or X7R — to minimize this change or drift of capacitor values over temperature, applied voltage, or aging.



## ALIGNMENT

Misalignment between inductors or other components is controlled to within  $\pm 10^\circ$  to meet MIL-F-28861 requirements. AVX Filters uses special techniques and fixtures to limit misalignment.

## CASE

This is a specially-drawn thin wall tubular brass case, designed so external stresses due to mismatched thermal coefficients of expansion are not transmitted to the brittle internal ceramic capacitor. The case will yield before a fracture can be induced in the capacitor element. **CAUTION:** Never grip the filter case with pliers or other tools as internal damage could result. A solder preform attaches the threaded end seal to the case.

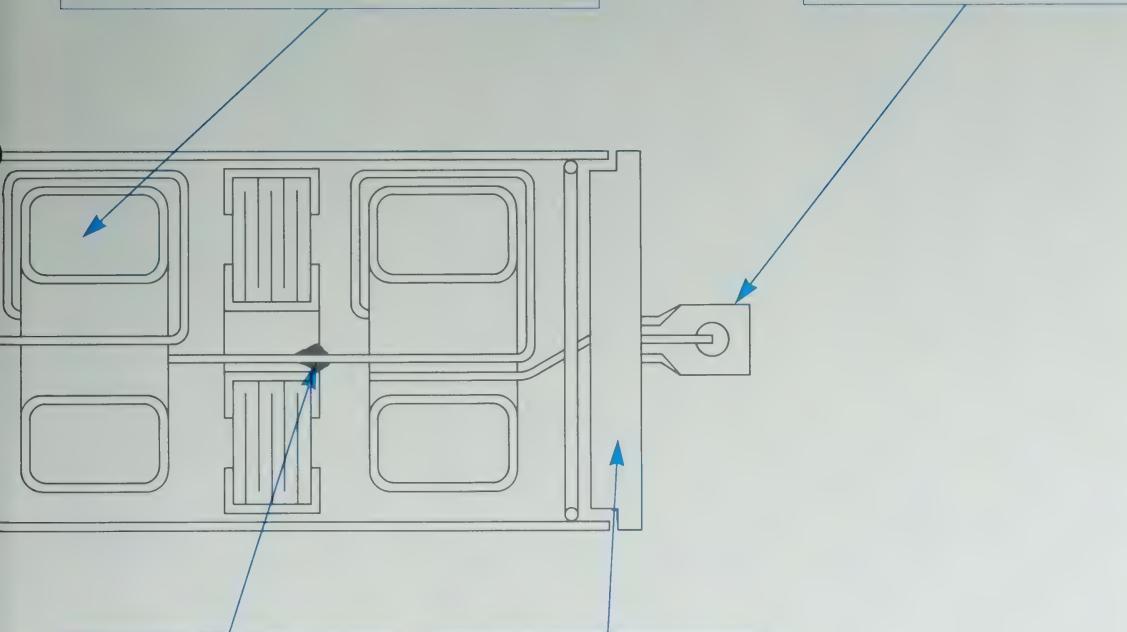
## INDUCTOR

A wound toroidal inductor design is used. It is encapsulated with epoxy to meet the 80% MIL-F-28861 coverage requirement to resist the shock and vibration commonly encountered in space and flight applications. The AVX Filters toroidal inductor design generally uses a molypermalloy MPP stabilized core, which provides volumetric efficiency, low saturation and high stability characteristics over the specified operating current and temperature ranges.

For the smaller solder-in, bolt styles, or high current filters, a ferrite bead is used for the inductor/lossy element. It is electrically equivalent to a single-turn toroid with a low DC saturation bias and low series resistance. The ferrite beads are coated with a high temperature, vapor-deposited polyimide for electrical insulation and additional protection against shock and vibration.

## TERMINAL

The filter flag terminals are made of an alloy 52 steel flattened and pierced tube that is fired into a compression seal configuration to form the filter end seal. A copper underplating is used to prepare the terminal for a corrosion resistant nickel plating (for moisture and salt spray resistance). Electro-tin plating for solderability and further corrosion resistance is then added. Other finishes such as gold, silver, or solder coat are also available.



## SOLDER

High lead content resilient solders are used on the interconnections to the capacitors to absorb stresses induced by mismatched coefficients of expansion.

## HERMETIC SEALS

Glass hermetic seals are available on many filter styles to preclude moisture or solvent penetration. These seals are treated to prevent the formation of sodium or calcium hydroxide thin films that can lower surface resistivity.

Final sealing of the filter is performed in a nitrogen atmosphere

# FILTER DESIGN GUIDE

## ENGINEERING DESIGN

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### Reliability must be designed in, not tested in.

When specifying a high reliability filter, several important design factors must be considered.

### Capacitor Temperature Voltage Stability

The K of a ceramic dielectric material does change over temperature. As a general rule, the higher the K, the more temperature-dependent the dielectric material. A ceramic capacitor built with a high K commercial dielectric will lose over 90% of its capacitance at higher operating temperatures (+125°C) and at full rated voltage.

Care must be taken to insure the stability of the capacitor dielectrics. Engineers specifying high-rel filters should use the military medium-to-low K dielectric grades that are stable over temperature. AVX Filters, for example, uses only ceramic capacitors with military grade stable dielectrics like NPO, BX, or X7R (see discoidal capacitor product pages for NPO, BX, and X7R specifications).

A military standard like MIL-F-28861 takes much of this into account by specifying both the allowable MIL-C-123 dielectric materials for Class S and the insertion loss at operating temperature extremes. This is not the case with many slash sheets on earlier standards like MIL-F-15733 or with many customer Spec Control Drawings. Engineers doing their own specifications or following MIL-F-15733 should specify

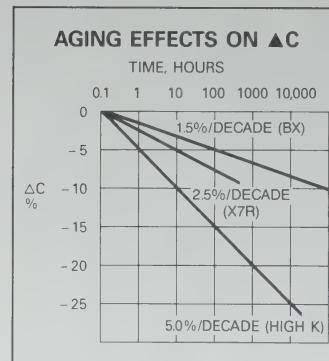
the filter's capacitor dielectric characteristics and insertion loss at temperature. Quality assurance tests should be included in the specification to verify the dielectric performance over temperature.

### Capacitor Aging

Ceramic dielectrics have a capacitance aging factor that relates to their K. The NPO dielectric exhibits minimal aging, the BX a maximum of 1½% per decade; and the X7R, 2½% per decade. For comparison, the high K dielectrics can show aging up to 8% per decade. After several decades, the dielectric appears to become relatively stable. However, if the dielectric is heated through or past its Curie point (118°C), perhaps by installation soldering or burn-in, the capacitance will

return to its initial value and the aging process will begin again. This can lead to receiving inspection problems as well as temperature-induced changes during filter operation.

Because it is usually not possible to guarantee that the filter device will not be heated above its Curie point, the capacitance "shift" should be considered by the circuit designer.



# FILTER DESIGN GUIDE

## □ Mechanically Rugged

Ceramic capacitors are piezoelectric within their operating temperature range. A sudden application of voltage can produce a high mechanical stress, or vice versa. The capacitor should be carefully laminated, with a good ceramic grain growth through the electrode pattern that integrates the capacitor electrodes into a single monolithic ceramic body.

## □ Insertion Loss

The insertion loss values specified throughout this catalog are based upon an industry standard of full load and balanced 50 ohm system in accordance with MIL-STD-220A (at +25°C). The actual attenuation performance in other circuits will vary significantly with different values of source and load impedance. AVX Filters' Application Engineering computer design capability can assist you in predicting these performance characteristics based upon your actual system impedances. The maximum drop in insertion loss at -55°C and +125°C is limited to 4 dB due to the stable capacitor dielectrics used in all designs.

The insertion loss values in this catalog may appear to be significantly lower than that of comparable filters in certain other competitor catalogs. The reason for this is that AVX Filters takes into account both component and circuit resonances and adjusts the table values such that the insertion loss will not drop below straight lines drawn between each data point in a semilog graph.

It should also be pointed out that the insertion loss performance will increase dramatically when you operate the filter below its rated full load current. This effect is especially pronounced for cylindrical filters which incorporate toroidal wound inductors. The inductors saturate less at lower currents, thereby raising both the real inductance and insertion loss.

AVX Filters' Application Engineers can accurately predict this effect for you.

## □ Resonant Dips

All feedthru capacitors have a self-resonant dip in their insertion loss versus frequency curves. This dip is predictable, and varies in frequency based on capacitance value. In this catalog and MIL-F-28861, the insertion loss data for each filter reflects the actual filter performance, including the dip due to internal resonance.

Another form of resonant dip is that of circuit resonance for a 2T filter such as a  $\pi$  or T. This resonance will also cause a dip, and it is predictable from an analysis of the filter network. All AVX Filters insertion loss data takes into account both capacitive and circuit resonance dips.

AVX Filters often must take exception to insertion loss values when quoting, because many specifications fail to allow for the "hidden" resonant dips which can occur between data points.

## □ Inductor Stability

The filter inductor is also subject to change over temperature. One way to insure stability is to use temperature stabilized cores for the toroidal inductor. For high cur-

rent, low inductance applications, AVX Filters uses special ferrite beads instead of wound cores. These provide low DC saturation bias, while maintaining an effective inductance and resistance at high frequencies.

## □ Circuit Selection

Filter circuits should be selected and installed with the applicable system impedances in mind. Feedthru capacitors should not be used in an environment subject to transient voltage conditions, because a surging current could damage the ceramic capacitor element. The L type filter should always have its inductor pointed towards the lowest impedance in the circuit to protect the capacitor. T filter configurations are ideal for circuits with both a low source and load impedance, because the ceramic capacitor is protected in both directions while the filtering function is optimized. A more complete description of the various filter circuits occurs in the filter types section of this catalog.



Insertion-Loss testing to 10GHz.

# FILTER DESIGN GUIDE

## MANUFACTURING CONTROL

To produce a high-rel filter, the manufacturing processes, the procedures, and the materials used must be kept under tight control. By monitoring and tagging these on a lot and order basis, any product failures or performance anomalies can be traced. At AVX Filters, such information is kept on file for later traceability and analysis.

### Kit Parts

For traceability and manufacturing flexibility, all parts for a given production order or lot are assembled and moved through production as a kit. This enables the lot to be separately treated, and easily moved off-line for additional processing, assembly or quality assurance. This approach is also designed to accommodate high-rel production to MIL-F standards such as 28861 and 15733.

All components that go into a production lot are separately qualified and inspected to the raw material Spec requirements, then assembled into a production kit. This includes components such as seals, lead wires, inductors, soldering material, etc. This procedure allows the production system to easily accommodate additional requirements for high-rel filter components.

### Training

MIL-F-28861, Class S, specifies a certified operator training program in accordance with MIL-STD-790. Operators are trained to work within the Class S baseline system. Quality Assurance inspectors are trained to verify quality under the stringent Class S in-process inspections and test.

### Traceability

Material lots, production processes, and product assembly steps are all traceable from a given filter production lot. All operations, processes and tests are logged on production lot travelers which provide a "travel" history of the filter within the production environment.

### SPC/SQC

Statistical Process and Statistical Quality Control rely on statistical sampling techniques to grade both products and processes. SPC is an auditing function that monitors processes using graphic techniques, and can detect a manufacturing process out of acceptable limits. SPC provides a "first alert" to potential problems, because it involves the people actually performing the manufacturing operations. X charts, P charts and Pareto analysis are some of the methods used to detect trends and highlight specific equipment or processes which may be out of control. SQC is also an auditing function, using statistical analysis of finished products as a predictor of product performance.

### Baseline

A baseline is a system of documentation that is used to guarantee manufacturing consistency, control change, and establish reporting structure. It sets up the mechanisms to define manufacturing, materials and components selection and qualification, as well as inspections and tests. It can also define mechanisms for direct comparisons to test the difference between lots and orders.

An example of a baseline is the MIL-F-28861 baseline that is defined for the space level components. With this baseline in place, all the mechanisms are defined to support Class S filter production and quality assurance. AVX Filters is qualified as a Class S facility. Changes to the baseline are monitored and approved by DESC,

NASA and Aerospace Corporation. Custom baselines can also be developed to fulfill specific customer requirements.

### ECO

An ECO-based system assures that each filter is produced in a controlled engineering/manufacturing environment. All changes to the filter design, materials, processing or assembly require an engineering change order (ECO) to each specific part number or specification. This provides a formal change mechanism on which both the customer and vendor can interface. By assigning a unique in-house part number to special filter designs, AVX Filters can provide change control over the life of the part. Part numbers can be assigned through source control drawings (SCDs) or through special purchase orders.

### MIL-STD-790

This standard sets up a full reliability assurance program plan with full traceability to raw materials, manufacturing processes, assembly, and tests. At AVX Filters there is full traceability down to the raw materials such as plating elements, base metals, ceramic materials, and inks, in accordance with MIL-STD-790. Other programs in this standard include failure analysis, documentation control and operator training requirements. MIL-F-28861 relies on this standard to define the reliability assurance program for the Class S filters.

### QPL

EMI filters which fully meet MIL standards are placed on a Qualified Products List (QPL) by a specifying agency such as DESC. The MIL-qualified filters can then be ordered directly by QPL part number. This is indicated by the MIL-F-28861 and MIL-F-15733 QPL sections of the catalog.

# FILTER DESIGN GUIDE

## RELIABILITY QUALITY ASSURANCE

A key factor in insuring quality components, and high reliability performance, is the implementation of appropriate tests and inspections during the manufacturing process.

There are a number of defined standards that specify the design parameters, tests and test setups, materials used, and the quality assurance provisions required.

Vendor parts that are qualified to the standards are put on QPL lists for that standard.

Design and component engineers can order these standard QPL filters with their attendant specifications. Other parameters can be added to meet specific needs or define a full quality assurance program.

### MIL-F-15733

This is an older standard developed for specifying EMI/RFI filters. It defines specific electrical and mechanical requirements, as well as stress tests and inspections. MIL-F-15733 does not require full 100% testing of each component, but relies upon sample testing for each lot.

It also defines quality assurance inspections, and specifies a quality assurance reporting mechanism with yearly reports required on overall quality assurance performance. It makes use of standards such as MIL-STD-202 to define test methods.

### MIL-F-28861

This is a modern standard, defining stringent classes of quality. The higher level, Class S, is for critical space type applications where failure may have catastrophic results. Detailed Group A screening and Group B environmental and qualification tests are fully described.

MIL-F-28861 is approved for use by all departments and agencies of the Department of Defense. Like the earlier 15733, it defines filters for EMI applications. How-



DESC approved X-Ray Lab.

ever, it goes into detailed requirements for a number of attributes such as baseline control, capacitor dielectrics, filter inductors, case and lead finishes, potting/impregnants, X-ray, DPA, SLAM and soldering methods.

Quality conformance inspection (QCI), or "Group A" testing, is performed on 100% of the filters for each production lot with limits on the number of failures allowed. For Class S filters, baseline documentation is required to track the major process steps and inspection points in manufacturing and quality assurance. This baseline also "locks" in the design through configuration control. Changes to the product design, or the process steps for defined areas, can only be done with formal government approval. Class "S" devices are qualified on a lot-by-lot basis, with Group A and B screening and testing documented on each manufacturing lot.

All AVX Filters internal design standards reflect these three standards of performance and reliability. For detailed information on these standards, see Filter Design Guide, M28861 Screening and R-Level Screening sections of catalog.

### Group A, B Tests

These tests or inspections are typically defined by MIL-F-28861 or MIL-F-15733. The Group A screening test sequence will include thermal shock, voltage conditioning, and the measurement of basic electrical parameters for the filter. It also defines visual and

radiographic inspections. All filters in a lot are 100% tested, when Group A per MIL-F-28861 is performed. Sample inspection of a filter lot is performed when Group A per MIL-F-15733 is specified.

Group A per MIL-F-28861 stipulates that up to 10% of tested Class B filters can be defective, and are simply removed from the lot. Failure rates in excess of 10% will cause the entire lot to be rejected.

Class S filters are only allowed PDA rates ranging from 2 to 3% on individual tests. If the combined total failures exceed 10%, then the lot must be scrapped.

Group B screening defines environmental tests on samples from the production lots. Some of these tests are destructive, including Destructive Physical Analysis (DPA). These tests permit a percentage of failure for each sampling of Class B Filters. No failures are permitted for Class S filters.

### DPA

Destructive Physical Analysis to RS-469 is a quality assurance technique that involves taking lot samples and cross-sectioning them for internal inspection. A filter is sectioned and then polished for microscopic examination. This is used to detect specific filter defects, such as flawed interconnects, capacitor voids, improper margins, dielectric separation (delamination), and improper dielectric grain growth. For detailed information see DPA Criteria section.

# FILTER DESIGN GUIDE

## FILTER RELIABILITY CODES S, B & R

### AVX Filters Reliability Code Levels Class S Class B Level R

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Based upon extensive field history and product characterization tests, AVX Filters has structured its internal design and test capability into three distinct reliability codes, Class S, Class B and Level R. These reliability codes dictate the design parameters of the monolithic ceramic capacitors utilized in the specific filter designs, as well as critical assembly processes, inspection criteria and associated screening.

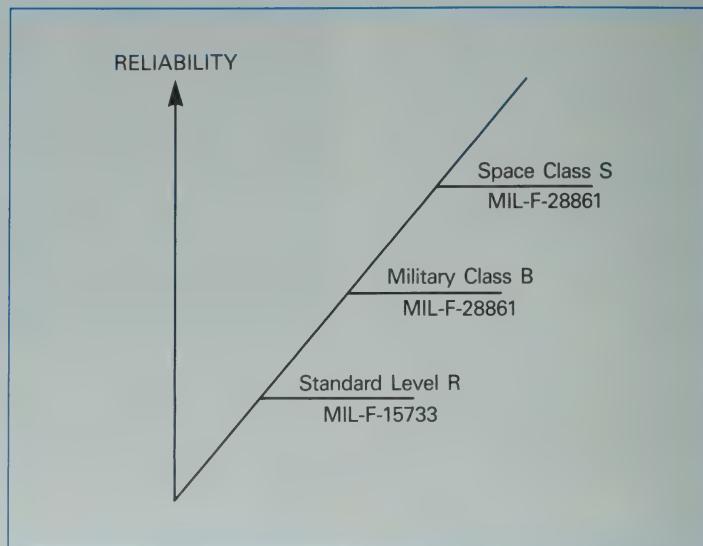
The three reliability code classifications S, B and R allow engineers to clearly specify reliability when defining requirements for semi-custom or custom parts.

## SUMMARY OF THE THREE RELIABILITY CODE LEVELS

### Class S

Defined by MIL-F-28861, Class S sets filter quality levels for space and other mission critical applications. Each manufacturing lot built to Class S undergoes a complete qualification to Group B of MIL-F-28861.

Class S also specifies a completely baselined engineering and manufacturing facility to insure quality production. It is an extremely stringent standard which



limits lot sizes, defines in-process inspections, and includes destructive physical analysis, radiographic (X-RAY) and detailed visual inspection (of both internal components and finished product). Class S also requires that ceramic discoidal capacitors be built to MIL-C-123 requirements which include additional inspections such as neutron radiography (N-RAY) or scanning laser acoustic microscopy (SLAM). See following pages for Class S Group A screening.

The capacitor destructive analysis criteria is in accordance with EIA RS-469. See DPA Criteria Discoidal Chip Capacitors.

### Class B

Defined under MIL-F-28861, this sets new material, performance and test standards for high reliability EMI filters. Class B meets or exceeds the requirements necessary for most aerospace and medical requirements with burn-in and life testing at 2x rated voltage. It is more stringent than the earlier MIL-F-15733, and requires 100% screening through Group A tests (including X-Ray). Qualification is maintained through performance of periodic Group B tests on units selected at random

# FILTER DESIGN GUIDE

from inspection lots. See following pages for Class B Group A screening.

The capacitor destructive analysis criteria for Class B is detailed on following pages.

## □ Level R

This AVX Filters test designation meets or exceeds the design requirements set by MIL-F-15733. Level R devices are generally recommended for ground based applications or where the failure of a component does not jeopardize mission success. Level R filters are designed for 125°C burn-in and life testing at 1.4 × rated voltage. Screening to MIL-F-15733 or the Level R test sequence is described on following pages.

The specific chip DPA requirements for Level R are detailed on the following pages.

## HOW TO ORDER

### □ Class S or B

To order the B or S reliability code simply replace the dash in the AVX Filters part number with the code letter B or S. For example a SA1B1-502 filter would become SA1B1B502. This would insure that the filter ordered would

receive all of the Class B manufacturing controls in addition to full 100% Group A screening in accordance with MIL-STD-28861, Class B.

### □ Level R

Unless otherwise specified, all filters are designed and built to the R reliability level (the minimum reliability level available from AVX Filters). However, they will not be subjected to R level screening unless specifically called out by the replacement of the dash in the part number with the R code. For example, a SA1B1-502 filter would be designed and manufactured to the R reliability level but would not receive the R level 100% high reliability screening sequence detailed on following pages.

A SA1B1R502 filter would receive the R level screening sequence.

Any waiver, modification, or custom screening/SCD requirement will be indicated by the addition of an individually assigned Alpha suffix to the end of the AVX Filters part number. These special Alpha suffix code letters may be obtained by calling AVX Filters Application Engineering.

Any filter may be furnished without screening, but AVX Filters considers the screening associated with the S, B or R reliability levels an integral part of supplying a high reliability filter product. Therefore, we strongly recommend that high-rel screening be performed. Filters ordered without high-rel screening would receive only the 100% production tests for Capacitance, Insulation Resistance (25°C), Dissipation

Factor, Dielectric Withstanding Voltage, and visual inspection.

The sequence of screening associated with Class S, Class B and Level R is detailed in the charts on the following pages.

## THE NEED FOR RELIABILITY

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Reliability must be designed in, it cannot be screened in.

Using a part built to lower reliability level and then screening it to meet a higher reliability specification is a dangerous policy. Even if the component passes the environmental and electrical tests, it still may fail in operation because the basic design may be inadequate.

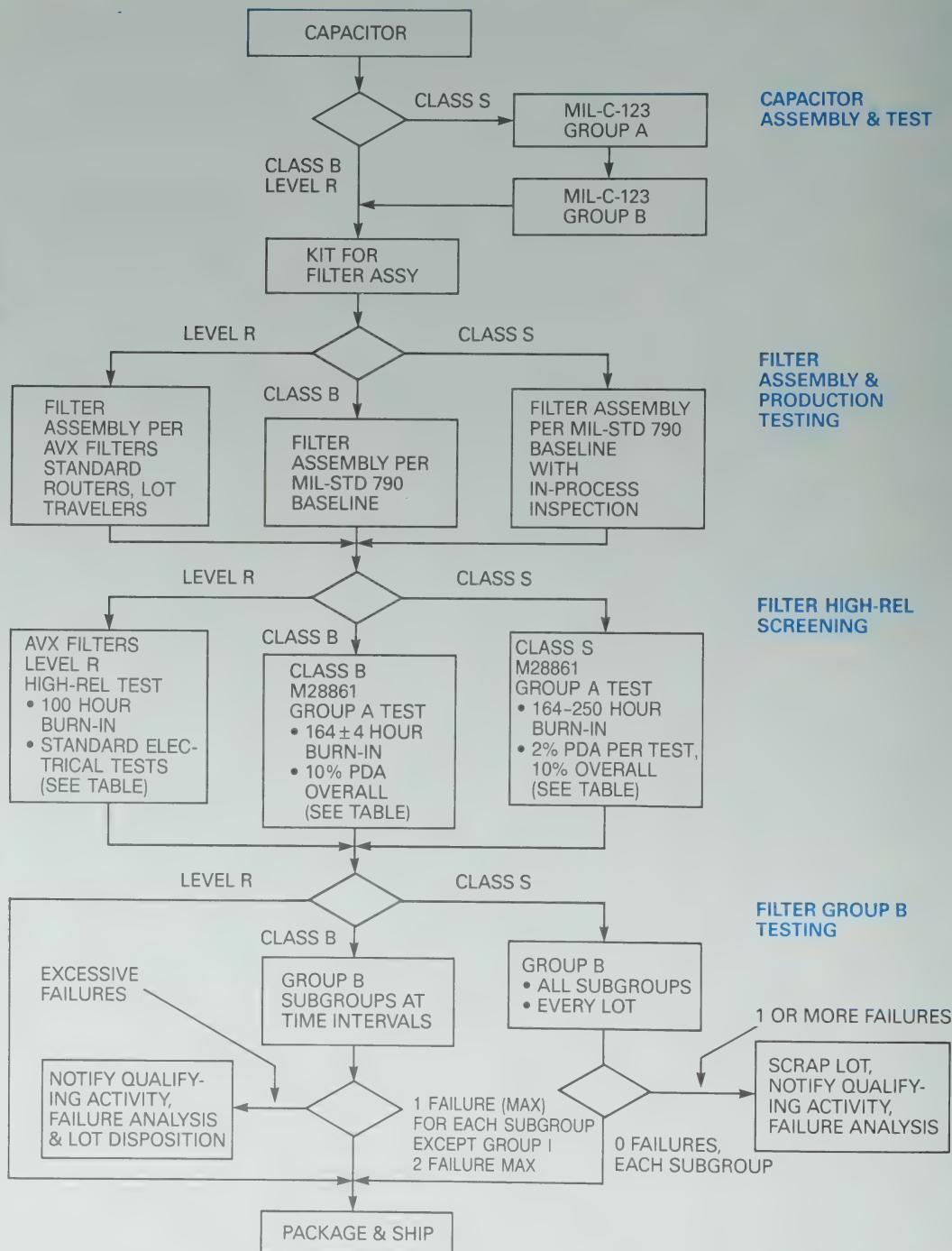
Another classic error is the practice of screening a high-rel part to a lesser reliability standard. This can be deceptive, because unless the part is stressed at its design limits, the screening may not be effective. Quality problems may slip through and, as a consequence, the part fails after installation in a system.

AVX Filters recommends that you select the proper reliability code and associated screening, either S, B or R, consistent with your requirements. Our Application Engineering staff will be pleased to assist you in making this determination.

# FILTER DESIGN GUIDE

Flow Chart –  
High Reliability Testing

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# FILTER DESIGN GUIDE

## M28861 SCREENING

### Class S, Class B

The Group A sequence as outlined in MIL-F-28861 is performed on a 100% basis whenever

Reliability Codes for Class S or Class B are specified by the customer. Differences between Class S and Class B screening are shown in the descriptions.

S-CLASS, B-CLASS TESTING		
TEST	MIL-STD-202 (method)	DESCRIPTION
Thermal shock	107, cond. A	S-class: 5 cycles from -55°C to +125°C. Through hole mounting required. B-class: as above except mounting not required.
Burn-in	108	S-class: 168 hours minimum at 2.0X rated voltage, 125°C polarity reversal for the first 24-72 hours; fused B/I circuit for each filter. B-class: 164 ± 4 hours at 2.0X rated voltage.
Dielectric Withstanding Voltage	301	S-class, B-class: 2.5X rated DC voltage for 5 seconds minimum, 1 minute maximum, 50 mA charging current.
Insulation Resistance	302, cond. A	S-class: test at 100 VDC or rated, V, whichever is less. Pass/fail limits are lot also based upon 125°C readings from first 50 pieces.
Capacitance and Dissipation Factor	305	B-class: same as above, except omit pass/fail as per 50 piece calculation. S-class, B-class: test at 1000 ± 100 Hz, 0.1 to 1.2 VRMS.
Insertion Loss	—	S-class, B-class: per MIL-STD 220 at load, no-load as specified.
DC Resistance	303	S-class, B-class: test is optional if DC Voltage Drop Test performed.
Voltage Drop	—	S-class, B-class: M28861 para 4.6.6.1 (AC rated), para 4.6.6.2 (DC rated)
Radiographic Inspection	209	S-class, B-class: 2 views required with 10X examination of images.
Seal Test	112	S-class: condition C B-class: condition A or D
Visual and Mechanical	—	S-class: M28861 para 4.6.1.2 which includes element, subassembly, and pre-cap inspections B-class: M28861 para 4.6.1.1 for external visual only.
Solderability	208	S-class, B-class: 5 samples.

# FILTER DESIGN GUIDE

## R-LEVEL SCREENING

The test sequence outlined below is performed whenever AVX Filters R-level screening is specified. Each filter lot is subjected to the tests in the order

shown on a 100% basis. Summary data is provided for R-level Screening and is included with shipment.

R-LEVEL TESTING		
TEST	MIL-STD-202 (method)	DESCRIPTION
Thermal shock	107, cond. A	5 cycles from $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ .
Burn-in	108, cond. A	100 hours at 1.4 times rated voltage, $+125^{\circ}\text{C}$ .
Dielectric Withstanding Voltage	301	Twice (2X) rated DC voltage for $5 \pm 1$ sec at $25^{\circ}\text{C}$ , 50 mA maximum charging current.
Insulation Resistance	302, cond. A	Testing performed at rated DC voltage. The $125^{\circ}\text{C}$ value shall be 10% of the specified IR at $25^{\circ}\text{C}$ .
Seal Test	112, cond. A	Gross leak test. Not applicable to epoxy-sealed units.
Depolarization	—	1 hour at $150^{\circ}\text{C}$ . No voltage applied.
Capacitance and Dissipation Factor	305	Test signal 1KHz, 1.0 VRMS.
DC Resistance Insertion Loss Check Test	303 —	DCR measured in lieu of voltage drop. Per MIL-F-15733 para 4.6.9.1.
Visual and Mechanical	—	Per MIL-F-15733 para 4.6.1.

# FILTER DESIGN GUIDE

## DPA AND OTHER SCREENING TECHNIQUES

### Destructive Physical Analysis

AVX Filters performs DPAs on each and every manufacturing lot of ceramic discoidal chip capacitors regardless of reliability level. Lots are then categorized based on RS-469 (EIA) requirements. A wide range of defects are evaluated, including:

- Delaminations,
- Voids,
- Margin Defects,
- Dielectric Non-uniformities,
- Ink Thickness.

See RS-469 and MIL-C-123 for additional details on defect criteria.

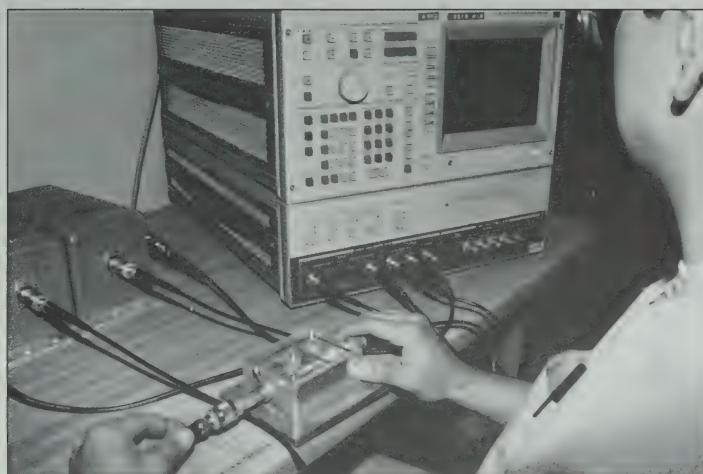
### Non-destructive Tests

Neutron Radiography (N-ray), Ultra Sonic scan, and scanning laser acoustic microscopy (SLAM) are MIL-C-123 non-destructive test techniques referenced by MIL-F-28861, Level S, to inspect capacitor chips for production and assembly flaws such as voids or delaminations. These non-destructive tests use either neutrons or acoustic energy to examine internal product structure, and often are combined with DPA sectioning for detailed examination.



X-Ray/DPA lab.

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High-Rel lab testing.

### PDA

Percent Defects Allowed is used to set a limit on the number of defects allowed during high-rel screening of filter production lots. If a production lot does not exhibit Group A defects in excess of its PDA, it is deemed acceptable for high-rel use. Lots exceeding the PDA are rejected.

All R-Level standard AVX Filters filters are screened to a company PDA limit defined by its MRB system. Customers may specify their own PDA limit for custom or semi-custom parts.

### Life Tests

These tests can be run on sample filters from a screened (Group A) lot. Analysis techniques, based on the behavior of these samples during testing, are used to project the lot's life performance. Life testing is usually an essential part of qualification.

# FILTER DESIGN GUIDE

## ENVIRONMENTAL TEST SPECS AND STANDARDS FOR EMI FILTERS

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### □ General Tests—MIL-STD-202

- Military Standard Test Methods For Electronic and Electrical Component Parts

#### METHOD 101

Salt Spray (corrosion)

- M15733: condition letter as specified per slash-dash number
- M28861: test condition A

#### METHOD 104

Immersion

- M15733: test condition A
- M28861: test condition A

#### METHOD 105

Barometric Pressure (reduced)

- M15733: test condition B
- M28861: test condition E

#### METHOD 106

Moisture Resistance

- M15733: thermal shock per Method 107, condition A, followed by Method 106
- M28861: thermal shock per Method 107, condition A, followed by Method 106

#### METHOD 107

Thermal Shock

- M15733: test condition A (125°C)
- M28861:
  - Class B: test condition A (125°C)
  - Class S: test condition A-1 (125°C)

#### METHOD 108

Life (at elevated ambient temperature)

- M15733: test condition B
- M28861: test condition D

#### METHOD 112

Seal

- M15733: condition A or D
- M28861:
  - Class B: condition A or D
  - Class S: condition C, IIIa followed by A or D

#### METHOD 201

Vibration

- M15733: para 4.6.17.1
- M28861: N/A

#### METHOD 204

Vibration, High Frequency

- M15733: condition A or B
- M28861: condition E

#### METHOD 208

Solderability

- M15733: applicable
- M28861: applicable

#### METHOD 209

Radiographic Inspection

- M15733: N/A
- M28861: para. 4.6.8

#### METHOD 210

Resistance To Soldering Heat

- M15733: condition B
- M28861: condition B

#### METHOD 213

Shock (specified pulse)

- M15733: as specified in slash sheet
- M28861: Class B: condition I Class S: condition F

#### METHOD 215

Resistance To Solvents

- M15733: applicable
- M28861: applicable

### □ MIL-F-15733 Tests

Current overload (para 4.6.10)

- This test is conducted with the filter suspended in free air with 140% of rated current applied. Ambient air temperature is specified as 20°C minimum.

### □ MIL-F-28861 Tests

Voltage and Temperature Limits of Capacitance (para. 4.6.10)

- This test is performed using a DC bias voltage. Capacitance is measured after filter temperature has stabilized for 30 minutes at each of the specified test temperatures.

Insertion Loss (at temperature) Para. 4.6.5.1

- Full load and no-load measurements of filter insertion loss at -55°C, +25°C, and +125°C.

Temperature Rise (para. 4.6.11)

- Test performed with filter suspended in free air with full rated current. Maximum hot spot location to be deter-

mined by thermocouple measurements.

Current Overload (para. 4.6.14)

- Substantially similar to overload test for MIL-F-15733

### □ MIL-C-123

Humidity, Steady-State, Low Voltage (para. 4.6.16.1)

- Low voltage humidity testing format often specified for non-hermetic filter designs.

## INSTALLATION, HANDLING, HARDWARE OPTIONS

### □ General

Proper Electrical Operation Requires:

- Good filter/case ground.
- Design layout where filter installed directly into conductive shield or enclosure.
- Minimizing holes, slots, or other penetrations of the shield near the filter.

Installation Precautions

- Although EMI/RFI filters can withstand temperature extremes, rapid heat-up or cool-down can crack the internal ceramic capacitor.
  - Pre-heating of the filter prior to soldering should be performed wherever possible.
  - Forced-air cooling after soldering is *not* recommended.

Avoid Mechanical Stress

- Do not use pliers or other gripping tools capable of exerting excessive pressure on filter case.
- Do not alter the lead or terminal flag either before or after soldering.

### □ Specific Recommendations

Hi-Temp Solder-In Style Filter

- Small case design sensitive to excessive heating.
- 150°C preheat prior to solder installation using supplied solder preform highly recommended.

# FILTER DESIGN GUIDE

- Vapor phase reflow (VPR) soldering with integral preheat is preferred.
- Infra-red (IR) and hot plate soldering may also be used.
- Temperature should be increased to solder temperature (300°C, max.) at a controlled rate of 2°C per second.
- Time at max. temperature should be kept at a minimum and should never exceed 30 seconds.
- When soldering leads using an iron:
  - Iron tip temperature should not exceed 460°F (60/40 solder recommended).
  - Use a small iron, 15-20 watts, and do not apply heat for longer than 10 seconds.
  - Use of heat sink clip when lead length permits is recommended.
- Do not expose leads to torque stresses by moving wires after soldering to lead. The glass hermetic seal may be damaged.
- Do not cut or form filter leads.
  - Mechanical stress may be transmitted to the discoidal capacitor.
  - The glass hermetic seal may be damaged.
  - Contact AVX Filters regarding custom lead lengths to accommodate your requirements.

## Bolt-Style Filters

- Do not exceed recommended nut mounting torques listed below. NOTE: it is preferable to keep to the low side of torque range when installing filters into threaded mounting holes.

- On epoxy sealed bolt-style units AVX Filters recommends conformal coating of the units after installation to improve moisture resistance.
- Observe same precautions listed for hi-temp filter when soldering to filter center pin.
- Do not bend filter center pin

**Cylindrical-Style Filters**

- Observe recommended nut mounting torque as per the table on previous page.
  - BK, CK, GK - series filters (1/4-28 UNF-2A) require  $44 \pm 4$  oz-in.
  - JD series (5/16-24 UNF-2A) require  $60 \pm 4$  oz-in.
- The terminal flags should not be subjected to mechanical stress during or after leadwire installation. The glass hermetic seal may be adversely affected.

- Use care in soldering to the terminal flags. An 18-30 watt soldering iron is recommended. CAUTION: the use of a large wattage iron without temperature control may cause reflow of the high-temperature solder used to seal the terminal. This could result in the loss of hermeticity for the filter.

## □ Hardware Options

### General

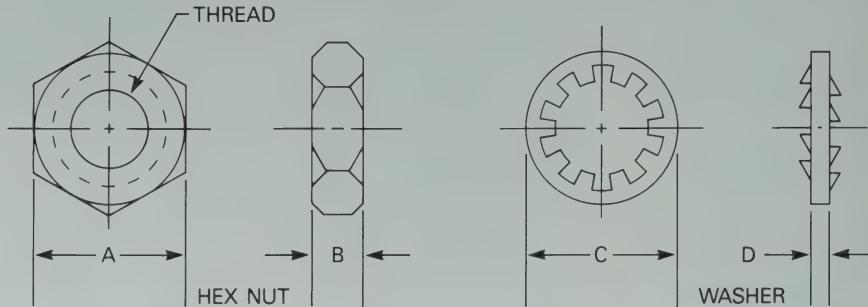
- Necessary mounting hardware is supplied with all filters.
- Hex nut and lockwasher plating will be as per filter case specified.
- Refer to table for hardware selection. Standard hardware ("STD") will be supplied unless otherwise requested. MIL-F-28861 filters will be shipped with MIL-F-28861 hardware.

Thread	Recommended Mounting Torque
(.112-40) 4-40 UNC-2A	32 oz-in. $\pm$ 4 oz-in.
(.164-32) 8-32 UNC-2A	64 oz-in. $\pm$ 4 oz-in.
(.190-32) 10-32 UNC-2A	64 oz-in. $\pm$ 4 oz-in.
(.216-32) 12-32 UNEF-2A	64 oz-in. $\pm$ 4 oz-in.
(.250-28) 1/4-28 UNF-2A	44 oz-in. $\pm$ 4 oz-in.
(.312-24) 5/16-24 UNF-2A	60 oz-in. $\pm$ 4 oz-in.

# SCREW & LOCKING WASHER TABLE

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## HEX NUT AND INTERNAL TOOTH LOCKWASHER



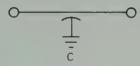
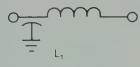
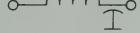
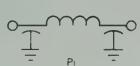
SIZE THREAD	HEX NUT		LOCKWASHER	
	A	B	C	D
4-40 UNC-2B (.112-40)	.187*	.067*	.225*	.020*
	.180	.057	.215	.010
	.257	.083	.265	.018
	.241	.073	.255	.012
8-32 UNC-2B (.164-32)	.250*	.083*	.285*	.025*
	.241	.073	.275	.015
	.313	.114	.336	.025
	.307	.104	.325	.015
10-32 UNF-2B (.190-32)	.250	.080	.311	.023
	.241	.070	.300	.013
	.345	.130	.381	.027
	.336	.120	.370	.017
12-32 UNEF-2B (.216-32)	.250	.083	.383	.023
	.241	.073	.372	.013
	.250*	.073*	.383*	.023*
	.241	.063	.372	.013
1/4-28 UNF-2B (.250-28)	.311*	.096*	.408*	.021*
	.308	.091	.396	.015
5/16-24 UNF-2B (.312-24)	.377*	.096*	.435*	.027*
	.365	.091	.425	.017

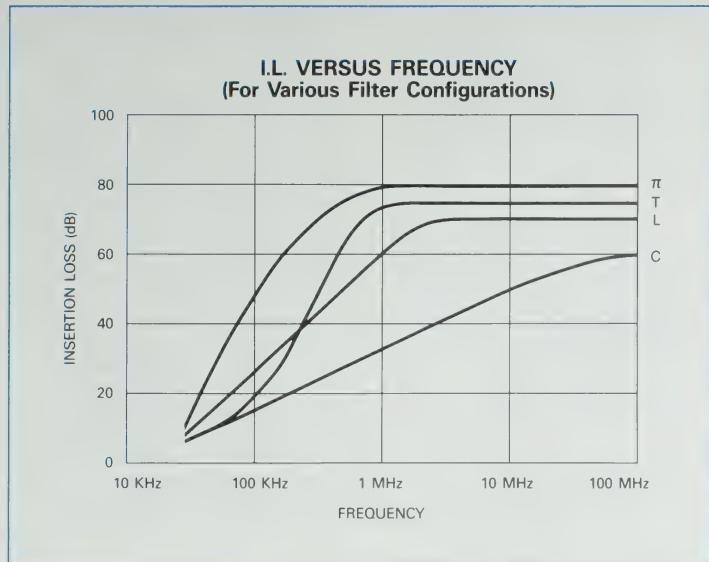
\*Used for MIL-F-28861 units.

# FILTER TYPES

3

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C	FEED-THRU FILTER		A feedthru is a low inductance device, acting as a bypass feedthru capacitor to ground. It works well with a high impedance load and source. For assured contact, it should be soldered directly to a bulkhead or a connector base. This filter should be avoided for use in circuits where large voltage transients occur; transients can damage the ceramic capacitor.
L	FILTER	 	This adds a series-inductive element to the bypass feedthru capacitor connected to ground. Because of the inductor, it can be connected to a low impedance source or load. This filter may be used to link a low impedance source to a high impedance load, or vice versa, with the feedthru capacitor facing the high impedance circuit.
$\pi$	$\pi$ FILTER		This filter contains two feedthru capacitors connected to ground with an inductor in-between. It presents a low impedance to both the source and load, and has a sharper roll-off than either the feedthru or L-section designs. With feedthru capacitors as outer elements, this filter is best suited for high impedance load and source applications.
T	T FILTER		This filter forms a 'T' with two inductors and a feedthru capacitor connected to ground. Like the $\pi$ Filter, it has a sharper roll-off than a feedthru or an L-section design. With inductors as outer elements, the T-section is intended for applications with a low impedance load and source. It also finds application where transient conditions may occur (EMP, lightning, etc.).
2T	MULTI-SECTION		Composed of 5 or more inductors and feedthru capacitors as filter elements, this has a sharper roll-off than other filter type. Each element contributes to the IL curve, increasing roll-off. As each new $\pi$ or T section is added, the IL slope is increased by up to 20 dB. This type of filter circuit is designed where substantial attenuation is required at relatively low frequencies down to 10 KHz. The sharp roll-off means that desired power-line frequencies are not suppressed.



# OPTIONS

A full range of options can be specified, ranging from custom circuit design to special mechanical packages, to testing and special quality assurance provisions. From initial design to final inspection, every AVX Filters operation is geared to accommodating special customer requirements. Standard electrical parameters, mechanical layouts, and finishes can be modified to meet project requirements. Testing and quality assurance procedures may also be tailored to special needs, and the entire manufacturing process is designed for high-rel production and lot monitoring.

Special services are also available, such as filter installation into arrays or brackets, furnished as assembled and 100% tested modules. Testing and qualifying of other vendor's parts are performed routinely as a customer service.

## ELECTRICAL OPTIONS

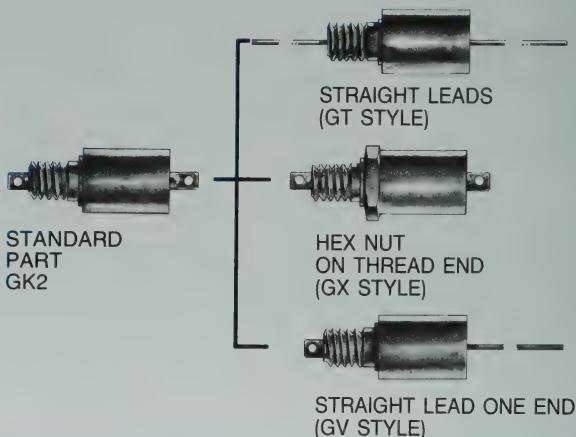
A full range of filter designs can be accommodated with filters capable of stop band performance to 26 GHz. Both DC and AC designs are available, with up to 400 VDC and 230 VAC - 400 Hz operating limits.

Designers can specify both capacitance and inductance for a variety of filter circuits, ranging from a simple feedthru capacitor to 2T networks. Simple T, L, and  $\pi$  circuits are also included.

By working with AVX Filters Application Engineers, designers can select capacitor dielectrics which insure temperature stability, limit internal resonance, and minimize voltage stresses. Designs can be specified for operation to 150°C, or the handling current of 15 Amps or greater. Current ratings can be adjusted by varying the lead diameter and length. Discoidal capacitor design modification may be involved as well.

Transient voltage devices can be added to a filter to suppress high level transients, protecting both the filter and the system circuitry beyond it. Filter performance

## CATALOG PARTS TO CUSTOM FILTERS



can also be characterized and tested under conditions to insure proper operation.

## MECHANICAL OPTIONS

There are many mechanical options available to the designer and components engineer. These include:

Filter cases of brass or steel; different thread sizes, as well as lengthening or shortening of the threaded portion; changes in terminal lead lengths and terminal flag lengths; and supplying of nail head or other formed leads for bolt-style terminals. In most cases, both hermetic and non-hermetic parts can be supplied, as well as special finishes and materials for leads and cases.

AVX Filters can also build custom filter arrays, where filters can be mounted through a plate or bracket to special mechanical assembly requirements. 100% final production testing at AVX Filters eliminates the possibility of user-generated problems en-

countered during assembly. A major advantage is that the assembled filter array can then be subjected to Group "A" 100% screening tests prior to shipment.

## QUALITY ASSURANCE OPTIONS

Any of the standard MIL-SPEC tests can be optionally performed as filters move through the manufacturing process. All MIL-F-15733 and MIL-F-28861 tests, in-process inspections, and qualification inspections can be incorporated into the manufacturing process.

Group A and Group B inspections to the MIL-F-28861 Class B and Class S are available as options. The AVX Filters-defined Level R testing, which meets or exceeds the requirements of MIL-F-15733, is also available.

## RELIABILITY OPTIONS

See Filter Reliability Codes section of catalog.

## ENGINEERING DESIGN CRITERIA

### Ceramic Capacitor Dielectric Characteristics, Class S and B, Level R.

- Operating temperature range: -55°C to +125°C
- Capacitance stability: specify EIA — X7R. NOTE: In some designs BX or NPO may be possible — see Filter Design Guide Engineering Design section.
- Maximum capacitance aging rate: specify 2.5% maximum.
- Internal defects — a destructive physical analysis (DPA) is required on every capacitor lot — see DPA Criteria section of Catalog for Class S and B, Level R criteria.

### Specify Filter Component Values and Characteristics

NOTE: If not shown on individual catalog page call Applications Engineering Department at AVX Filters for specified values.

- Capacitance minimum/maximum
- Inductance minimum/maximum (at no load/full load).
- Maximum DC resistance or voltage drop.
- Voltage and current (DC and AC/Hz)
- Over voltage and/or over current conditions, if any such as EMP, lightning (MIL-STD-704) etc.

### Environmental Requirements

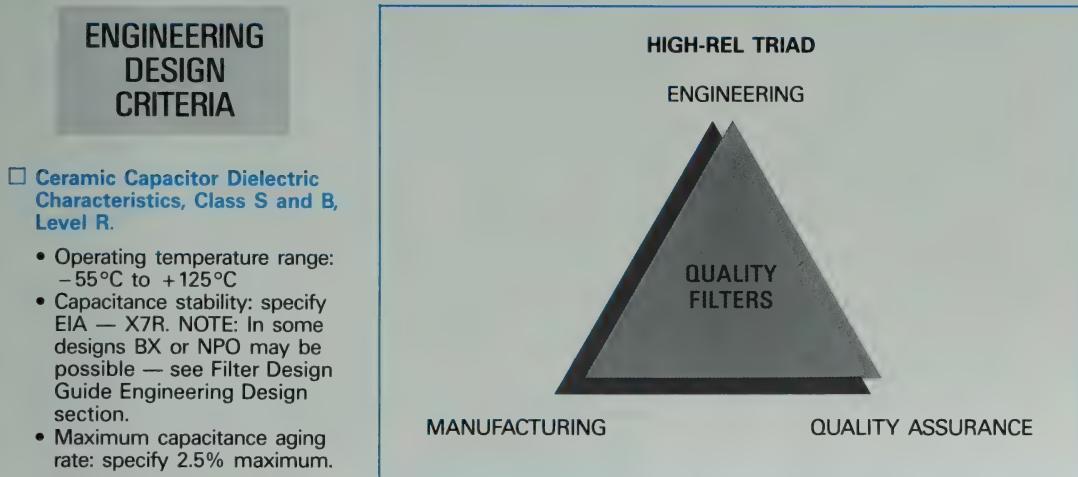
Specify all applicable environmental requirements such as shock, vibration, moisture resistance, resistance to soldering heat, etc. Use MIL-F-28861, MIL-F-15733, MIL-STD-202 and the applicable product pages of this catalog as guidelines.

Class S: MIL-F-28861  
Group B Table IV  
Class S

Class B: MIL-F-28861  
Group B Table IV  
Class B

Level R: MIL-F-15733

## HIGH-REL TRIAD



- Filter schematic (C, L,  $\pi$ , T, etc)
- Insertion loss in a 50 ohm system per MIL-STD-220A (at no load for C filters and at full load on all others).
- Insulation resistance (IR) at both +25°C and +125°C. NOTE: IR should never be less than: 1000 megohms  $\times$  microfarads at +25°C, and 100 megohms  $\times$  microfarads at +125°C, or 50,000 Megohms, whichever is less.
- Dielectric withstanding voltage (usually 2  $\times$  rated DC voltage).

## MANUFACTURING/ QUALITY CONTROL

### Manufacturers Quality Control System Must Meet:

Class S = MIL-Q-9858

Class B = MIL-I-45208

Level R = MIL-I-45208

### Traceability

All filter lots must be built from kits (not bins). From the final filter lot number the manufacturer must have full traceability to all raw materials, every manufacturing step and inspection per MIL-I-45208.

### SPC, SQC

The manufacturer must use statistical process control and statistical quality control methods in order to insure consistency of the finished product.

# SCD CHECKLIST

For Specifying A High-Reliability Filter  
Class S and B, Level R

## Process Documentation and Engineering Change Control

- **Class S** Full baseline configuration control documentation system per MIL-F-28861 audited and controlled by DESC, NASA, and Aerospace Corp. (or a custom baseline controlled by the customer).
- **Class B** MIL-I-45208 & MIL-STD-790
- **Level R** MIL-I-45208

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## RELIABILITY ASSURANCE TESTS (Stress Screening)

### Reliability Assurance Program Plan

The manufacturer must fully comply with the requirements of MIL-STD-790 including process documentation, failure analysis (defect analysis program), formal operator training program and product audits.

### 100% Group A Screening

- **Class S** Per MIL-F-28861 Class S. NOTE: Class S also includes nondestructive capacitor screening per MIL-C-123 (N-ray or SLAM)
- **Class B** Per MIL-F-28861 Class B.
- **Level R** Per Level R Screening table in Filter Design Guide section of catalog or per Group A MIL-F-15733 except that all tests, except insertion loss, will be 100% not AOL.

## Qualification of Supplier

- **Class S** lot-by-lot qual per MIL-F-28861, Class S, Table III.
- **Class B** Perform qualification tests per MIL-F-28861 Table III, Class B (maintenance of qual per same spec).
- **Level R** Manufacturer to have MIL-SPEC qualifications to MIL-F-15733 or MIL-F-28861 or produce SCD qualification data on a similar device. An option is to require qualification per MIL-F-15733 Table IX.

- Include caution note: "When bending, forming, or cutting filter terminal (leads) grip or hold the terminal at the filter body to prevent stress from fracturing hermetic seals or internal components."

## Avoid Thermal Shock, or Over-heating

Filters must be heated and cooled at controlled rates. Also maximum installation temperatures must not be exceeded. See Installation, Handling Notes section for complete criteria.

## Post Installation Tests

It is recommended that the user conduct electrical tests on the installed filter unit to insure that the installation process caused no component degradation. These tests may include capacitance, dissipation factor, and insulation resistance. A desirable option is to have the filter manufacturer install the filter component on a bracket or plate. This way the 100% Group A screening is more effective as it is performed after the component has seen installation stress. See Multi-Component Filter Bracket section of catalog.

## INSTALLATION CONTROL

### Prevent Mechanical Over Stress

- Specify mounting torque, see Installation, Handling section of catalog.
- Include caution note: "Do not grip the filter body with pliers or other such tools, as damage can occur to sensitive internal components."

# SOLDER-IN STYLE



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**Solder-In Style Hi-Temp EMI Filters—  
300°C Installation Temperature  
Series**

- ZZ - .118 Dia.
- ZS/ZR - .128 Dia.
- YS/YR - .165 Dia.
- XS/XR - .250 Dia.
- WS/WR - .690 Dia.

(See Advanced Technology Section for new .100 diameter version, new hermetic 400°C version, and the aluminum compatible version.)





## APPLICATIONS

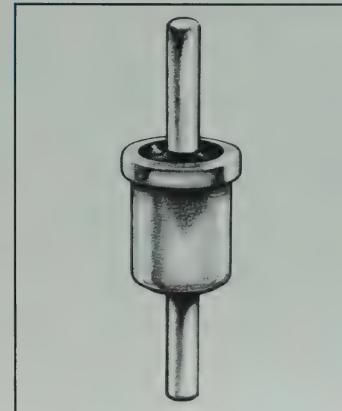
The ZZ series is intended for use as a high reliability alternative to a commonly available commercial filter type. Due to its smaller body diameter, capacitance is limited. It does provide effective filtering in the MICROWAVE frequency spectrum from 100 MHz through 26 GHz. Designed to be soldered into a package, bracket or bulkhead (and maintain hermeticity), it is ideal for high impedance circuits where large capacitance values are not practical.

Alternate lead lengths or special capacitance values are available upon request.

Custom packages or bracket assemblies utilizing this feedthru can be furnished to your specifications.

## CHARACTERISTICS

- High temperature construction withstands 300°C installation temperatures.
- Features rugged monolithic discoidal capacitor construction.
- Glass hermetic seal on one end with epoxy seal on the opposite end.
- High purity gold plating provides excellent solderability or compatibility with thermal and ultrasonic wire bonding.



## SPECIFICATIONS

1. Finish: Gold standard - Silver and solder coat available
2. Material:
  - Case: Cold rolled steel
  - Leads: Iron-nickel alloy
3. Operating Temperature Range: -55°C to +125°C
4. Insulation Resistance:
  - At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less
  - At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less
5. Dielectric Withstanding Voltage (DWV): R-level designs:
  - 2.0 times rated DC voltage
  - Class B, Class S designs:
    - 2.5 times rated DC voltage
6. DC Resistance (DCR): .01 ohm, maximum
7. Dissipation Factor (DF): 3% maximum
8. Rated DC Current: 5 Amps, maximum
9. Maximum Installation Temperature: 300°C
10. Supplied with 60/40 solder preform for easy installation

**STANDARD CONFIGURATION**  
(See Note 1)

Top View Dimensions (Left):

- Outer diameter: .118 ± .002
- Inner diameter: .140 ± .005

Side View Dimensions (Right):

- Outer diameter: .020 ± .005
- Lead length: .040 ± .002
- Lead diameter: .040 ± .002
- Lead thickness: .040 ± .002
- Lead width: .400 ± .020
- Lead gap: A = .110 ± .005
- Lead gap: B = .140 ± .020

**METRIC EQUIVALENTS**

IN	MM	IN	MM
.002	.05	.120	.305
.005	.13	.135	.343
.020	.51	.140	.356
.040	.102	.145	.368
.110	.279	.400	.1016
.116	.295	—	—

(See Note 2)

**NOTES:**

1. Glass seal on end opposite flange.
2. Metric equivalent dimensions given for information only.

**CIRCUIT DIAGRAM**



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

ZZ SERIES Circuits Available - C

.118 DIA.

## SPECIFICATIONS

AVX P/N	Current AMP	Ckt	DC Voltage	<sup>1</sup> CAP Min.	Full Load Insertion Loss Per MIL-STD-220, +25°C					<sup>2</sup> Rel. Codes
					10 MHz	100 MHz	1000 MHz	10 GHz		
ZZ1C3-250H	5	C	50	25	—	—	—	10	25	— R B S
ZZ1C3-500H	5	C	50	50	—	—	1	15	30	— R B S
ZZ1C3-101H	5	C	50	100	—	—	3	20	40	— R B S
ZZ1C3-102H	5	C	50	1000	—	4	18	36	53	— R B S
ZZ1C3-152H	5	C	50	1500	—	5	21	42	55	— R B S
ZZ1A3-250H	5	C	100	25	—	—	—	10	25	— R B S
ZZ1A3-500H	5	C	100	50	—	—	1	15	30	— R B S
ZZ1A3-101H	5	C	100	100	—	—	3	20	40	— R B S
ZZ1A3-102H	5	C	100	1000	—	4	18	36	53	— R B S
ZZ1A3-152H	5	C	100	1500	—	5	21	42	55	— R B S
ZZ1B3-250H	5	C	200	25	—	—	—	10	25	— R B S
ZZ1B3-500H	5	C	200	50	—	—	1	15	30	— R B S
ZZ1B3-101H	5	C	200	100	—	—	3	20	40	— R B S
ZZ1B3-102H	5	C	200	1000	—	4	18	36	53	— R

<sup>1</sup>Decimal point values indicate capacitance in microfarads.

Non decimal point values indicate capacitance in picofarads.

<sup>2</sup>See Filter Design Guide, Reliability Levels.

For special multi-unit assemblies see Multi-Component Filter Brackets section.



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

## ZS/ZR SERIES

300°C Installation Temperature

Circuits Available - C &amp; L

.128 DIA.

## APPLICATIONS

The ZS series provides effective filtering in the MICROWAVE frequency spectrum from 10 MHz through 26 GHz. Designed to be soldered into a package, bracket or bulkhead (and maintain hermeticity), it is ideal for high impedance circuits where large capacitance values are not practical. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and provides superior transient performance.

Alternate lead lengths or special capacitance values may be ordered.

Custom packages or bracket assemblies utilizing this feedthru can be furnished to your specifications.

## SPECIFICATIONS

1. Plating: Gold standard - Silver and solder coat available

2. Material:

Case: Cold rolled steel

Leads: Alloy 52 steel

3. Operating Temperature Range:

-55°C to +125°C

4. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less

At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less

5. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

6. DC Resistance (DCR): .01 ohm, maximum

7. Dissipation Factor (DF): 3% maximum

8. Rated DC Current: 5 Amps, maximum

9. Maximum Installation Temperature: 300°C

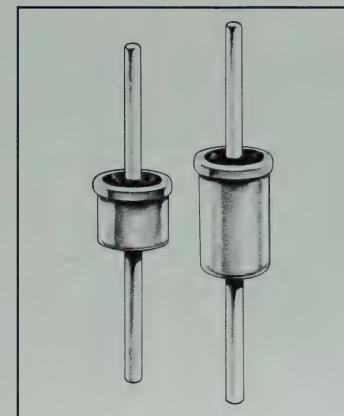
10. Supplied with 60/40 solder preform for easy installation

11. Insertion Loss for the "C" and "L" circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current.

At lower currents the "L" becomes much more effective

## CHARACTERISTICS

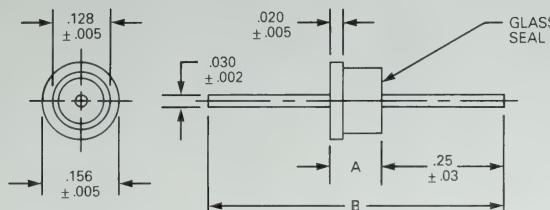
- Meets or exceeds the applicable portions of MIL-F-28861/12. See QPL listings.
- High temperature construction withstands 300°C installation temperatures.
- Features rugged monolithic discoidal capacitor construction.
- Glass hermetic seal on one end with epoxy seal on the opposite end.
- High purity gold plating provides excellent solderability or compatibility with thermal and ultrasonic wire bonding.



4

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## STANDARD CONFIGURATION



## METRIC EQUIVALENTS

IN	MM	IN	MM
.002	.005	.128	.325
.005	.013	.156	.396
.020	.051	.200	.508
.030	.076	.25	.64
.03	.08	.625	.1588
.110	.279	.715	.1816

(See Note 4)

CIRCUIT DIAGRAM	DIMENSIONS	
	A ± .005	B NOM.
L	.200	.715
C	.110	.625

## NOTES:

1. Outline drawing shows standard ZS configuration.

Also available with glass seal at the opposite end.

ZR reverse configuration.

2. MIL-F-28861/12 style FS70 equivalent to standard ZS configuration. Style FS71 is reverse ZR configuration.

3. For ZS2 or ZR2 L-Section Filters inductor always positioned at epoxy-filled end.

4. Metric equivalent dimensions given for information only.

MIL-F-28861/12 (See Note 2)

DASH NO	STYLE
001 through 016, 033 and 034	FS70
017 through 032, 035 and 036	FS71

## CIRCUIT DIAGRAMS



ZS1, ZR1

ZS2

(See Note 3)

ZR2



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

**ZS/ZR SERIES**

300°C Installation Temperature

Circuits Available - C &amp; L

.128 DIA.

**SPECIFICATIONS**

AVX P/N	Current AMP	Ckt	DC Voltage	¹CAP Min.	Full Load Insertion Loss Per MIL-STD-220, +25°C							²M28861 EQUIV.	³Rel. Codes
					1 MHz	10 MHz	100 MHz	1000 MHz	10 GHz				
ZS1C2-501H	5	C	50	500	—	—	—	15	34	50	—	—	R B S
ZS1C2-102H	5	C	50	1000	—	—	4	18	36	53	—	—	R B S
ZS1C2-122H	5	C	50	1200	—	—	5	20	40	55	—	—	R B S
ZS1C2-272H	5	C	50	2700	—	—	10	25	45	60	—	—	R B S
ZS1C2-502H	5	C	50	5000	—	0	15	30	50	60	—	—	R B S
ZS1C2-103H	5	C	50	.010	—	4	20	35	50	60	/12-034	R B	
ZS1C2-153H	5	C	50	.015	—	7	25	40	60	60	/12-002	R B	
ZR1C2-103H	5	C	50	.010	—	4	20	35	50	60	/12-036	R B	
ZR1C2-153H	5	C	50	.015	—	7	25	40	60	60	/12-018	R B	
ZS2C2-501H	5	L	50	500	—	0	0	15	34	55	—	—	R B S
ZS2C2-102H	5	L	50	1000	—	—	4	19	43	55	—	—	R B S
ZS2C2-122H	5	L	50	1200	—	—	5	20	45	55	—	—	R B S
ZS2C2-272H	5	L	50	2700	—	—	10	28	50	60	—	—	R B S
ZS2C2-502H	5	L	50	5000	—	—	15	35	55	60	—	—	R B S
ZS2C2-103H	5	L	50	.010	—	4	20	38	55	60	/12-033	R B	
ZS2C2-153H	5	L	50	.015	—	7	25	45	60	60	/12-001	R B	
ZR2C2-103H	5	L	50	.010	—	4	20	38	55	60	/12-035	R S	
ZR2C2-153-H	5	L	50	.015	—	7	25	45	60	60	/12-017	R B	
ZS1A2-101H	5	C	100	100	—	—	—	3	20	40	—	—	R B S
ZS1A2-501H	5	C	100	500	—	—	—	15	34	55	—	—	R B S
ZS1A2-102H	5	C	100	1000	—	—	4	18	36	53	—	—	R B S
ZS1A2-122H	5	C	100	1200	—	—	5	20	40	55	—	—	R B S
ZS1A2-272H	5	C	100	2700	—	—	10	25	50	60	/12-004	R B S	
ZS1A2-507H	5	C	100	5000	—	—	15	30	50	60	/12-006	R B S	
ZS1A2-103H	5	C	100	.010	—	4	20	35	50	60	—	R B	
ZS1A2-153H	5	C	100	.015	—	7	25	40	55	60	—	R	
ZR1A2-272H	5	C	100	2700	—	—	10	25	50	60	/12-020	R B S	
ZR1A2-502H	5	C	100	5000	—	—	15	30	50	60	/12-022	R B S	
ZS2A2-100H	5	L	100	10	—	—	—	—	15	20	—	—	R B S
ZS2A2-250H	5	L	100	25	—	—	—	—	20	25	—	—	R B S
ZS2A2-101H	5	L	100	100	—	—	—	5	20	40	—	—	R B S
ZS2A2-501H	5	L	100	500	—	—	—	15	34	55	—	—	R B S
ZS2A2-102H	5	L	100	1000	—	—	4	19	43	55	—	—	R B S
ZS2A2-122H	5	L	100	1200	—	—	5	20	45	55	—	—	R B S
ZS2A2-272H	5	L	100	2700	—	—	10	25	50	60	/12-003	R B S	
ZS2A2-502H	5	L	100	5000	—	—	15	30	55	60	/12-005	R B S	
ZS2A2-103H	5	L	100	.010	—	4	20	38	55	60	—	R B	
ZS2A2-153H	5	L	100	.015	—	7	25	45	60	60	—	R	
ZR2A2-272H	5	L	100	2700	—	—	10	25	50	60	/12-019	R B S	
ZR2A2-502H	5	L	100	5000	—	—	15	30	50	60	/12-021	R B S	

¹Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

²Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

³See Filter Design Guide, Reliability Levels.

continued

For special multi-unit assemblies see Multi-Component Filter Brackets section.



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

**ZS/ZR SERIES**

300°C Installation Temperature

Circuits Available - C &amp; L

.128 DIA.

## SPECIFICATIONS

Full Load Insertion Loss Per MIL-STD-220, +25°C

continued

AVX P/N	Current AMP	CKT	DC Voltage	'CAP Min.	1 MHz	10 MHz	100 MHz	1000 MHz	10 GHz	<sup>2</sup> M28861 EQUIV.	<sup>3</sup> Rel. Codes
ZS1B2-100H	5	C	200	10	—	—	—	—	5	20	/12-008 R B S
ZS1B2-250H	5	C	200	25	—	—	—	—	10	25	/12-010 R B S
ZS1B2-101H	5	C	200	100	—	—	—	3	20	40	/12-012 R B S
ZS1B2-501H	5	C	200	500	—	—	—	15	34	50	/12-014 R B S
ZS1B2-102H	5	C	200	1000	—	—	4	20	40	55	/12-016 R B S
ZS1B2-122H	5	C	200	1200	—	—	5	20	40	55	— R B S
ZS1B2-272H	5	C	200	2700	—	—	10	25	45	60	— R
ZR1B2-100H	5	C	200	10	—	—	—	—	5	20	/12-024 R B S
ZR1B2-250H	5	C	200	.25	—	—	—	—	10	25	/12-026 R B S
ZR1B2-101H	5	C	200	100	—	—	—	3	20	40	/12-028 R B S
ZR1B2-501H	5	C	200	500	—	—	—	15	34	50	/12-030 R B S
ZR1B2-102H	5	C	200	1000	—	—	4	20	40	55	/12-032 R B S
ZS2B2-100H	5	L	200	10	—	—	—	—	15	20	/12-007 R B S
ZS2B2-250H	5	L	200	25	—	—	—	—	20	25	/12-009 R B S
ZS2B2-101H	5	L	200	100	—	—	—	3	20	40	/12-011 R B S
ZS2B2-501H	5	L	200	500	—	—	—	15	34	55	/12-013 R B S
ZS2B2-102H	5	L	200	1000	—	—	4	20	45	55	/12-015 R B S
ZS2B2-122H	5	L	200	1200	—	—	5	20	45	55	— R B S
ZS2B2-272H	5	L	200	2700	—	—	10	28	50	60	— R
ZR2B2-100H	5	L	200	10	—	—	—	—	15	20	/12-023 R B S
ZR2B2-250H	5	L	200	25	—	—	—	—	20	25	/12-025 R B S
ZR2B2-101H	5	L	200	100	—	—	—	3	20	40	/12-027 R B S
ZR2B2-501H	5	L	200	500	—	—	—	15	34	55	/12-029 R B S
ZR2B2-102H	5	L	200	1000	—	—	4	20	45	55	/12-031 R B S

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.

For special multi-unit assemblies see Multi-Component Filter Brackets section.

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SOLDER-IN STYLE HIGH TEMP EMI FILTERS

## YS/YR SERIES

300°C Installation Temperature

Circuits Available - C &amp; L

.165 DIA.

## APPLICATIONS

The YS series provides increased filtering in the MICROWAVE frequency spectrum from 1 MHz through 10 GHz. Previously unavailable in the industry as a solder-in device, this unique design offers higher values of capacitance than were previously available. Designed to be soldered into a package, bracket or bulk-head (and maintain hermeticity), it is ideal for high impedance circuits where large capacitance values are not practical. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and provides superior transient performance.

Alternate lead lengths or special capacitance values may be ordered.

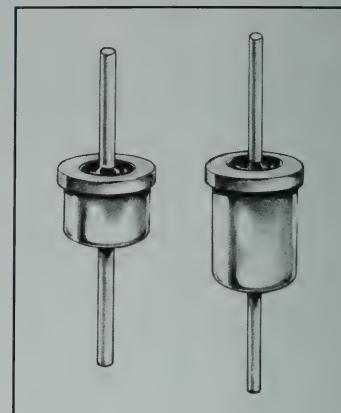
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Custom packages or bracket assemblies utilizing this feedthru can be furnished to your specifications.

## CHARACTERISTICS

- Meets or exceeds the applicable portions of MIL-F-28861/15. See QPL listings.
- High temperature construction withstands 300°C installation temperatures.
- Features rugged monolithic discoidal capacitor construction.
- Glass hermetic seal on one end with epoxy seal on the opposite end.
- High purity gold plating provides excellent solderability or compatibility with thermal and ultrasonic wire bonding.



## SPECIFICATIONS

1. Plating: Gold standard - Silver available
2. Material:
  - Case: Cold rolled steel
  - Leads: Alloy 52 steel
3. Operating Temperature Range: -55°C to +125°C
4. Insulation Resistance:
  - At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less
  - At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less
5. Dielectric Withstanding Voltage (DWV): R-level designs:
  - 2.0 times rated DC voltage
  - Class B, Class S designs:
    - 2.5 times rated DC voltage
6. DC Resistance (DCR): .01 ohm maximum
7. Dissipation Factor (DF): 3% maximum
8. Rated DC Current: 5 Amps maximum
9. Maximum Installation Temperature: 300°C
10. Supplied with 60/40 solder preform for easy installation
11. Insertion Loss for the "C" and "L" circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current. At lower currents the "L" becomes much more effective

**STANDARD CONFIGURATION**

**METRIC EQUIVALENTS**

CIRCUIT DIAGRAM	IN	MM	IN	MM
L	.002	.005	.165	4.19
.005	.013	.200	5.08	
.025	.064	.250	6.35	
.03	.08	.650	16.51	
.032	.081	.750	19.05	
.150	.381	—	—	

(See Note 4)

**NOTES:**

1. Outline drawing shows standard YS configuration. Also available with glass seal at the opposite end, YR reverse configuration.
2. MIL-F-28861/15 style A equivalent to standard YS configuration. Style B is reverse YR configuration.
3. For YS or YR L-Section Filters inductor always positioned at epoxy-filled end.
4. Metric equivalent dimensions given for information only.

**MIL-F-28861/15 (See Note 2)**

DASH NO.	CONFIGURATION
001 through 004	A
005 through 008	B

**CIRCUIT DIAGRAMS**

YS1, YR1      YS2      (See Note 3)      YR2



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

YS/YR SERIES

300°C Installation Temperature

Circuits Available - C &amp; L

.165 DIA.

## SPECIFICATIONS

Full Load Insertion Loss Per MIL-STD-22Q, +25°C

AVX P/N	Current AMP	DC Voltage	'CAP Min.	500 KHz	1 MHz	10 MHz	100 MHz	1000 MHz	10 GHz	<sup>2</sup> M28861 EQUIV.	<sup>3</sup> Rel. Codes
YS1C2-152H	5	C	50	1500	—	5	21	42	55	—	R B S
YS1C2-502H	5	C	50	5000	—	15	34	50	60	—	R B S
YS1C2-103H	5	C	50	.010	—	4	20	35	53	60	—
YS1C2-153H	5	C	50	.015	—	7	25	40	55	60	—
YS1C2-203H	5	C	50	.020	—	8	27	41	60	65	—
YS1C2-273H	5	C	50	.027	14	10	30	42	65	70	—
YS1C2-503H	5	C	50	.050	9	15	35	44	70	70	—
YS1C2-753H	5	C	50	.075	12	18	37	46	70	70	—
YS1C2-104H	5	C	50	.1	4	20	38	48	70	70	—
YS2C2-152H	5	L	50	1500	—	—	6	22	48	55	—
YS2C2-502H	5	L	50	5000	—	—	15	35	55	60	—
YS2C2-103H	5	L	50	.010	—	4	20	36	57	60	—
YS2C2-153H	5	L	50	.015	—	7	25	45	60	60	—
YS2C2-203H	5	L	50	.020	—	8	27	46	62	65	—
YS2C2-273H	5	L	50	.027	4	10	30	48	65	70	—
YS2C2-503H	5	L	50	.050	9	15	36	50	70	70	—
YS2C2-753H	5	L	50	.075	12	18	37	51	70	70	—
YS2C2-104H	5	L	50	.1	14	20	39	52	70	70	—
YS1A2-152H	5	C	100	1500	—	—	5	21	42	55	—
YS1A2-502H	5	C	100	5000	—	—	15	34	50	60	—
YS1A2-103H	5	C	100	.010	—	4	20	35	53	60	—
YS1A2-153H	5	C	100	.015	—	7	25	40	55	60	—
YS1A2-203H	5	C	100	.020	—	8	27	41	60	65	—
YS1A2-273H	5	C	100	.027	—	10	30	42	65	70	/15-002
YS1A2-503H	5	C	100	.050	9	15	35	44	70	70	—
YS1A2-753H	5	C	100	.075	12	18	37	46	70	70	—
YR1A2-273H	5	C	100	.027	—	10	30	42	65	70	/15-006
YS2A2-152H	5	L	100	1500	—	—	6	22	48	55	—
YS2A2-502H	5	L	100	5000	—	—	15	35	55	60	—
YS2A2-103H	5	L	100	.010	—	4	20	36	57	60	—
YS2A2-153H	5	L	100	.015	—	7	25	45	60	60	—
YS2A2-203H	5	L	100	.020	—	8	27	46	62	65	—
YS2A2-273H	5	L	100	.027	—	10	30	48	65	70	/15-001
YS2A2-503H	5	L	100	.050	9	15	36	50	70	70	—
YS2A2-753H	5	L	100	.075	12	18	37	51	70	70	—
YR2A2-273H	5	L	100	.027	—	10	30	48	65	70	/15-005

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

continued

<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.

For special multi-unit assemblies see Multi-Component Filter Brackets section.



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

YS/YR SERIES

300°C Installation Temperature

Circuits Available - C &amp; L

.165 DIA.

## SPECIFICATIONS

continued

AVX P/N	Current AMP	Ckt	DC Voltage	'Cap Min.	Full Load Insertion Loss Per MIL-STD-220, +25°C							^M28861 EQUIV.	^Rel. Codes
					500 KHz	1 MHz	10 MHz	100 MHz	1000 MHz	10 GHz			
YS1B2-152H	5	C	200	1500	—	—	5	21	42	55	—	R B S	
YS1B2-502H	5	C	200	5000	—	—	15	34	50	60	/15-004	R B S	
YS1B2-103H	5	C	200	.010	—	4	20	35	53	60	—	R	
YS1B2-153H	5	C	200	.015	—	7	25	40	55	60	—	R	
YS1B2-203H	5	C	200	.020	—	8	27	41	60	65	—	R	
YS1B2-273H	5	C	200	.027	4	10	30	42	65	70	—	R	
YR1B2-502H	5	C	200	5000	—	—	15	34	50	60	/15-008	R B S	
YS2B2-152H	5	L	200	1500	—	—	6	22	48	55	—	R B S	
YS2B2-502H	5	L	200	5000	—	—	15	35	55	60	/15-003	R B S	
YS2B2-103H	5	L	200	.010	—	4	20	36	57	60	—	R	
YS2B2-153H	5	L	200	.015	—	7	25	45	60	60	—	R	
YS2B2-203H	5	L	200	.020	—	8	27	46	62	65	—	R	
YS2B2-273H	5	L	200	.027	4	10	30	48	65	70	—	R	
YR2B2-502H	5	L	200	5000	—	—	15	35	55	60	/15-007	R B S	

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.

For special multi-unit assemblies see Multi-Component Filter Brackets section.



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

## XS/XR SERIES

300°C Installation Temperature

Circuits Available - C &amp; L

.250 DIA.

## APPLICATIONS

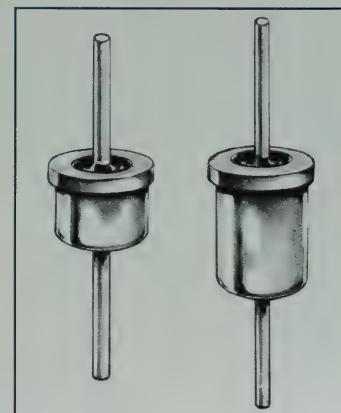
The XS series expands upon the YS offering by providing additional filtering in the HF through MICRO-WAVE frequency spectrum from 500 KHz up to 10 GHz. The larger diameter of the XS series means that even higher values of capacitance and a rated DC current of 10 Amps are available. Designed to be soldered into a package, bracket or bulkhead (and maintain hermeticity), it is ideal for medium to high impedance circuits where significant amounts of capacitance to ground can be tolerated. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and provides superior transient performance.

Alternate lead lengths or special capacitance values may be ordered.

Custom packages or bracket assemblies utilizing this feedthru can be furnished to your specifications.

## CHARACTERISTICS

- Meets or exceeds the applicable portions of MIL-F-28861/14. See QPL listings.
- High temperature construction withstands 300°C installation temperatures.
- Features rugged monolithic discoidal capacitor construction.
- Glass hermetic seal on one end with epoxy seal on the opposite end.
- High purity gold plating provides excellent solderability or compatibility with thermal and ultrasonic wire bonding.



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## SPECIFICATIONS

1. Plating: Gold standard - Silver available  
2. Material:

Case: Cold rolled steel

Leads: Alloy 52 steel

3. Operating Temperature Range:  
-55°C to +125°C

4. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less

At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less

5. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

6. DC Resistance (DCR): .01 ohm, maximum

7. Dissipation Factor (DF): 3% maximum

8. Rated DC Current: 10 Amps, maximum

9. Maximum Installation Temperature:

300°C

10. Supplied with 60/40 solder preform for easy installation

11. Insertion Loss for the "C" and "L" circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current. At lower currents the "L" becomes much more effective

**STANDARD CONFIGURATION**

**METRIC EQUIVALENTS**

IN	MM	IN	MM
.002	.005	.150	.381
.005	.013	.250	.635
.025	.064	.290	.737
.03	.08	.650	.1651
.032	.081	.750	.1905

(See Note 4)

CIRCUIT DIAGRAM	DIMENSIONS	
	A	B
	± .005	REF.
L	.250	.750
C	.150	.650

**NOTES:**

- Outline drawing shows standard XS configuration. Also available with glass seal at the opposite end, XR reverse configuration.
- MIL-F-28861/14 configuration A is equivalent to standard XS configuration. B is reverse XR configuration.
- For XS2 or XR2 L-Section Filters inductor always positioned at epoxy-filled end.
- Metric equivalent dimensions given for information only.

MIL-F-28861/14 (See Note 2)

DASH NO.	CONFIGURATION
001 through 006	A STD
007 through 012	B REV

**CIRCUIT DIAGRAMS**

XS1, XR1

XS2

(See Note 3)

XR2



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

## XS/XR SERIES

300°C Installation Temperature

Circuits Available - C &amp; L

.250 DIA.

## SPECIFICATIONS

AVX P/N	Current AMP	CKT	DC Voltage	¹CAP Min.	Full Load Insertion Loss Per MIL-STD-220, +25°C							²M28861 EQUIV.	³Rel. Codes
					500 KHz	1 MHz	10 MHz	100 MHz	1000 MHz	10 GHz			
XS1C2-503H	10	C	50	.050	9	15	35	44	70	70	—	R B S	
XS1C2-753H	10	C	50	.075	12	18	37	46	70	70	—	R B S	
XS1C2-104H	10	C	50	.1	14	20	38	48	70	70	—	R B S	
XS1C2-154H	10	C	50	.15	17	24	38	50	70	70	—	R B	
XS1C2-254H	10	C	50	.25	21	31	40	55	70	70	—	R	
XS2C2-503H	10	L	50	.050	9	15	36	50	70	70	—	R B S	
XS2C2-753H	10	L	50	.075	12	18	37	51	70	70	—	R B S	
XS2C2-104H	10	L	50	.1	14	20	39	52	70	70	—	R B S	
XS2C2-154H	10	L	50	.15	17	26	40	53	70	70	—	R B	
XS2C2-254H	10	L	50	.25	21	31	40	56	70	70	—	R	
XS1A2-503H	10	C	100	.050	9	15	35	44	70	70	—	R B S	
XS1A2-753H	10	C	100	.075	12	18	37	46	70	70	—	R B S	
XS1A2-104H	10	C	100	.1	14	20	38	48	70	70	/14-002	R B S	
XR1A2-104H	10	C	100	.1	14	20	38	48	70	70	/14-008	R B S	
XS2A2-503H	10	L	100	.050	9	15	36	50	70	70	—	R B S	
XS2A2-753H	10	L	100	.075	12	18	37	51	70	70	—	R B S	
XS2A2-104H	10	L	100	.1	14	20	39	52	70	70	/14-001	R B S	
XR2A2-104H	10	L	100	.1	14	20	39	52	70	70	/14-007	R B S	
XS1B2-153H	10	C	200	.015	—	5	25	40	55	60	—	R B S	
XS1B2-223H	10	C	200	.022	2	8	26	40	58	70	/14-004	R B S	
XR1B2-223H	10	C	200	.022	2	8	26	40	58	70	/14-010	R B S	
XS2B2-153H	10	L	200	.015	—	5	25	45	60	60	—	R B S	
XS2B2-223H	10	L	200	.022	2	8	27	45	65	70	/14-003	R B S	
XR2B2-223H	10	L	200	.022	2	8	27	45	65	70	/14-009	R B S	
XS1L2-103H	10	C	300	.010	—	3	20	35	52	60	/14-006	R B S	
XR1L2-103H	10	C	300	.010	—	3	20	35	52	60	/14-012	R B S	
XS2L2-103H	10	L	300	.010	—	3	20	38	55	60	/14-005	R B S	
XR2L2-103H	10	L	300	.010	—	3	20	38	55	60	/14-011	R B S	

¹Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

²Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

³See Filter Design Guide, Reliability Levels.

For special multi-unit assemblies see Multi-Component Filter Brackets section.

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## APPLICATIONS

The WS series expands greatly upon the XS and YS offerings by providing increased filtering in the HF through MICROWAVE frequency spectrum from 500 KHz up to 10 GHz. The large diameter of the WS series means even higher values of capacitance, a rated DC current of 15 Amps, plus 125 VAC/400 Hz ratings are available. Designed to be soldered into a package, bracket or bulkhead (and maintain hermeticity), it is ideal for low to medium impedance circuits where large amounts of capacitance to ground can be tolerated. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and provides superior transient performance.

Alternate lead lengths or special capacitance values may be ordered.

## SPECIFICATIONS

1. Plating: Gold standard - Silver available

2. Material:

Case: Cold rolled steel

Leads: Alloy 52 steel

3. Operating Temperature Range:

-55°C to +125°C

4. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less

At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less

5. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

6. DC Resistance (DCR): .01 ohm, maximum

7. Dissipation Factor (DF): 3% maximum

8. Rated DC Current: 15 Amps, maximum

9. Maximum Installation Temperature:

300°C

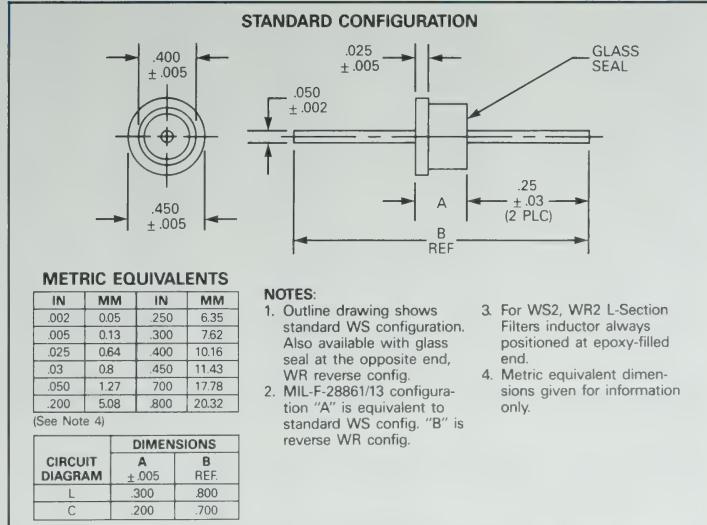
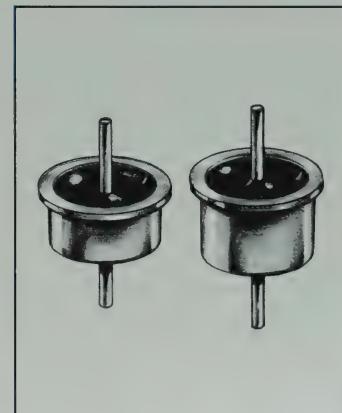
10. Supplied with 60/40 solder preform for easy installation

11. Insertion Loss for the "C" and "L" circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current. At lower currents the "L" becomes much more effective

Custom packages or bracket assemblies utilizing this feedthru can be furnished to your specifications.

## CHARACTERISTICS

- Meets or exceeds the applicable portions of MIL-F-28861/13. See QPL listings.
- High temperature construction withstands 300°C installation temperatures.
- Features rugged monolithic discoidal capacitor construction.
- Glass hermetic seal on one end with epoxy seal on the opposite end.
- High purity gold plating provides excellent solderability or compatibility with thermal and ultrasonic wire bonding.



## CIRCUIT DIAGRAMS

DASH NO.	CONFIG.
001 through 008	A
009 through 016	B

MIL-F-28861/13  
(See Note 2)



WS1, WR1



WS2, WR2  
(See Note 3)



SOLDER-IN STYLE HIGH TEMP EMI FILTERS

## WS/WR SERIES

300°C Installation Temperature  
Circuits Available - C & L .400 DIA.

## SPECIFICATIONS

AVX P/N	Current AMP	Circuit	DC Voltage	'CAP MIN	Full Load Insertion Loss Per MIL-STD-220, +25°C							^M28861 EQUIV.	^Rel. Codes
					500 KHz	1 MHz	10 MHz	100 MHz	1000 MHz	10 GHz			
WS1C2-154H	15	C	50	.15	17	24	38	50	70	70	—	—	R B
WS1C2-504H	15	C	50	.50	26	34	42	58	70	70	—	—	R B
WS1C2-754H	15	C	50	.75	31	37	43	62	70	70	—	—	R B
WS1C2-125H	15	C	50	1.2	33	37	52	70	70	70	—	/13-002	R
WR1C2-125H	15	C	50	1.2	33	37	52	70	70	70	—	/13-010	R
WS2C2-154H	15	L	50	.15	17	26	40	53	70	70	—	—	R B
WS2C2-504H	15	L	50	.50	26	36	44	60	70	70	—	—	R B
WS2C2-754H	15	L	50	.75	31	40	44	64	70	70	—	—	R B
WS2C2-125H	15	L	50	1.2	33	38	53	70	70	70	—	/13-001	R
WR2C2-125H	15	L	50	1.2	33	38	53	70	70	70	—	/13-009	R
WS1N2-704H	15	C	70	.70	30	36	41	60	70	70	—	/13-004	R B
WR1N2-704H	15	C	70	.70	30	36	41	60	70	70	—	/13-012	R B
WS2N2-704H	15	L	70	.70	30	38	42	62	70	70	—	/13-003	R B
WR2N2-704H	15	L	70	.70	30	38	42	62	70	70	—	/13-011	R B
WS1A2-154H	15	C	100	.15	17	24	38	50	70	70	—	—	R B
WS1A2-504H	15	C	100	.50	26	34	42	58	70	70	—	/13-006	R B
WS1A2-754H	15	C	100	.75	31	37	43	62	70	70	—	—	R
WS1A2-105H	15	C	100	1.0	31	40	48	64	70	70	—	—	R
WR1A2-504H	15	C	100	.50	26	34	42	58	70	70	—	/13-014	R B
WS2A2-154H	15	L	100	.15	17	26	40	53	70	70	—	—	R B
WS2A2-504H	15	L	100	.50	26	34	44	60	70	70	—	/13-005	R B
WS2A2-754H	15	L	100	.75	31	40	44	64	70	70	—	—	R
WS2A2-105H	15	L	100	1.0	31	41	50	65	70	70	—	—	R
WR2A2-504H	15	L	100	.50	26	34	44	60	70	70	—	/13-013	R B
WS1L2-503H	15	C	200*	.050	7	15	34	42	70	70	—	/13-008	R B
WS1L2-154H	15	C	200*	.15	17	24	38	50	70	70	—	—	R B
WR1L2-503H	15	C	200*	.050	7	15	34	42	70	70	—	/13-016	R B
WS2L2-503H	15	L	200*	.050	7	15	34	42	70	70	—	/13-007	R B
WS2L2-154H	15	L	200*	.15	17	26	40	53	70	70	—	—	R B
WR2L2-503H	15	L	200*	.050	7	15	34	42	70	70	—	/13-015	R B
WS1E2-103H	15	C	400	.010	—	4	20	34	50	60	—	—	R B
WS1E2-503H	15	C	400	.050	9	15	35	44	70	70	—	—	R
WS2E2-103H	15	L	400	.010	—	4	20	35	55	60	—	—	R B
WS2E2-503H	15	L	400	.050	9	15	36	48	70	70	—	—	R

\*Also rated 125 VAC/400 Hz

^Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

^Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

^See Filter Design Guide, Reliability Levels.

For special multi-unit assemblies see Multi-Component Filter Brackets section.

# BOLT STYLE



**Bolt Style EMI Filters**  
Series

- SA 4/40 Thread
- SB 8/32 Thread
- SH 10/32 Thread
- SP 12/32 Thread
- SN 12/32 Thread





## APPLICATIONS

The SA series provides effective filtering in the RF and MICRO-WAVE frequency spectrums from 10 MHz through 26 GHz. Designed for mounting in a tapped bulkhead or with the standard nut and lockwasher provided, it is ideal for high impedance circuits where large capacitance values are not practical. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and provides superior transient performance.

The SA series comes with a standard .020 diameter beryllium copper lead. Alternate lead lengths, diameters of .016 or .026 and alternate materials in steel or half-hard copper are available.

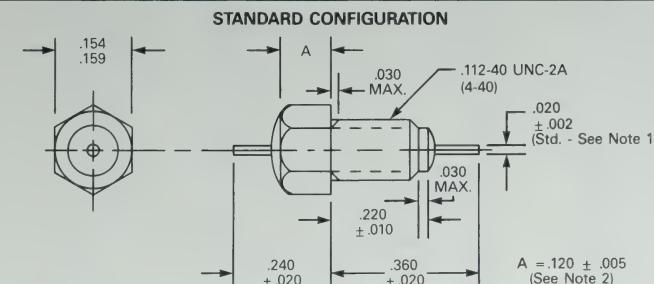
## CHARACTERISTICS

- Meets or exceeds the applicable portions of MIL-F-28861/6. See QPL listings.
- Smallest screwbody filter available.
- Features rugged monolithic discoidal capacitor construction.
- Epoxy seal on both ends.



## SPECIFICATIONS

1. Plating: Silver standard - Electro-tin or gold available
2. Material:
  - Case: Cold rolled steel standard, brass available.
  - Leads: Beryllium copper (steel or half/hard copper leads available)
3. Operating Temperature Range: -55°C to +125°C
4. Insulation Resistance:
  - At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less
  - At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less
5. Dielectric Withstanding Voltage (DWV):
  - R-level designs: 2.0 times rated DC voltage
  - Class B, Class S designs: 2.5 times rated DC voltage
6. DC Resistance (DCR): .02 ohm, maximum
7. Dissipation Factor (DF): 3% maximum
8. Rated DC Current: 5 Amps, maximum
9. Recommended Mounting Torque: 32 oz-in.  $\pm$  4 oz-in.
10. Supplied with mounting nut and lockwasher - See Filter Design Guide Screw and Locking Washer Table.
11. Insertion Loss for the "C" and "L" sections are equivalent due to the saturation characteristic of the ferrite bead element at rated current. At lower currents the "L" becomes much more effective



## METRIC EQUIVALENTS

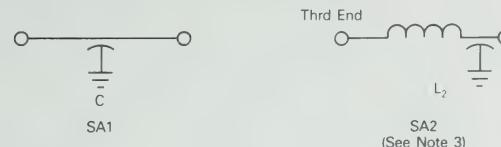
IN	MM	IN	MM
.002	.005	.120	.305
.005	.013	.145	.368
.010	.025	.154	.391
.016	.041	.159	.404
.020	.051	.220	.559
.026	.066	.240	.610
.030	.076	.360	.914
.112	.284	—	—

(See Note 4)

## NOTES:

1. Standard catalog designs have .020" dia. lead. MIL-F-28861/6 calls for .026" dia. .026" dia. will not be supplied unless specified.
2. "A" dimension of .120  $\pm$  .005 will satisfy M28861-6-003 requirement for .145  $\pm$  .030. All "SA" series are supplied A = .120  $\pm$  .005.
3. All SA2 L Section Filters have inductor (bead) at threaded end.
4. Metric equivalent dimensions given for information only.

## CIRCUIT DIAGRAMS



**BOLT STYLE EMI FILTERS****SA SERIES****4-40 Thread - Epoxy Sealed  
Circuits Available - C & L****SPECIFICATIONS**

AVX P/N	CKT	'CAP	DC Voltage	Full Load Insertion Loss Per MIL-STD-220, +25°C								<sup>2</sup> M15733 EQUIV.	<sup>2</sup> M28861 EQUIV.	<sup>3</sup> Rel. Codes
				1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz	—	—			
SA1C1-102	C	1000	50	.02	—	4	20	25	40	50	—	—	—	R B S
SA1C1-502	C	5000	50	.02	—	15	34	41	45	50	—	—	—	R B S
SA1C1-103	C	.01	50	.02	4	21	35	40	55	60	—	—	—	R B S
SA1C1-273	C	.027	50	.02	10	30	39	45	65	70	—	—	—	R B S
SA1C1-503	C	.05	50	.02	15	35	42	50	70	70	—	—	—	R B
SA2C1-102	L2	1000	50	.02	—	4	20	27	45	70	—	—	—	R B S
SA2C1-502	L2	5000	50	.02	—	15	35	41	55	70	—	—	—	R B S
SA2C1-103	L2	.01	50	.02	4	21	35	38	65	70	—	—	—	R B S
SA2C1-273	L2	.027	50	.02	10	30	50	54	65	70	—	—	—	R B S
SA2C1-503	L2	.05	50	.02	15	36	54	60	70	70	—	—	—	R B
SA1A1-102	C	1000	100	.02	—	4	20	25	40	50	—	—	—	R B S
SA1A1-502	C	5000	100	.02	—	15	34	41	45	50	—	—	—	R B S
SA1A1-103	C	.01	100	.02	4	21	35	40	55	60	—	—	—	R B S
SA1A1-273	C	.027	100	.02	10	30	39	45	65	70	—	—	/6-001	R B S
SA1A1-453	C	.045	100	.02	14	35	53	60	70	70	—	—	—	R B
SA2A1-102	L2	1000	100	.02	—	4	20	27	45	70	—	—	—	R B S
SA2A1-502	L2	5000	100	.02	—	15	35	41	55	70	—	—	—	R B S
SA2A1-103	L2	.01	100	.02	4	21	35	38	65	70	—	—	—	R B S
SA2A1-273	L2	.027	100	.02	10	30	50	54	70	70	—	—	/6-002	R B S
SA2A1-453	L2	.045	100	.02	14	37	52	58	70	70	—	—	/6-003	R B
SA1B1-102	C	1000	200	.02	—	4	20	25	40	55	—	—	/6-004	R B S
SA1B1-502	C	5000	200	.02	—	15	34	41	50	55	—	—	/6-005	R B S
SA1B1-103	C	.01	200	.02	4	21	35	42	55	70	—	—	/6-006	R B
SA2B1-102	L2	1000	200	.02	—	4	20	27	45	70	—	—	—	R B S
SA2B1-502	L2	5000	200	.02	—	15	35	41	55	70	—	—	—	R B S
SA2B1-103	L2	.01	200	.02	4	21	35	38	65	70	—	—	/6-007	R B

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.

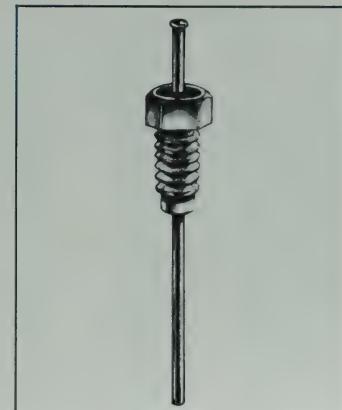


## APPLICATIONS

The SB series provides improved filtering in the HF through MICRO-WAVE frequency spectrums from 1 MHz through 10 GHz. Also designed for mounting in a tapped bulkhead or with the standard nut and lockwasher provided, it is ideal for medium to high impedance circuits where large capacitance values are not practical. In the "L" and "π" section versions an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves the insertion loss rolloff to 40 dB and 60 dB per decade respectively.

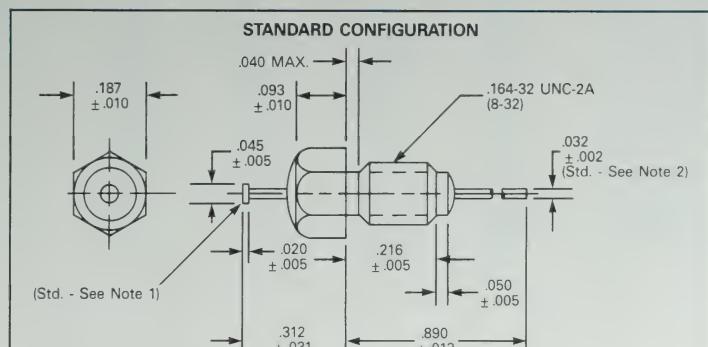
## CHARACTERISTICS

- Designed to meet or exceed the applicable portions of MIL-F-28861/7. See QPL listings.
- $\pi$  design offers steeper insertion loss rolloff.
- Features rugged monolithic discoidal capacitor construction.
- Epoxy seal on both ends.



## SPECIFICATIONS

1. Plating: Silver standard - Electro-tin or gold available
2. Material:
  - Case: Cold rolled steel
  - Leads: Half/hard copper
3. Operating Temperature Range: -55°C to +125°C
4. Insulation Resistance:
  - At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less
  - At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less
5. Dielectric Withstanding Voltage (DWV):
  - R-level designs: 2.0 times rated DC voltage
  - Class B, Class S designs: 2.5 times rated DC voltage
6. DC Resistance (DCR): .01 ohm, maximum
7. Dissipation Factor (DF): 3% maximum
8. Rated DC Current: 10 Amps, maximum
9. Recommended Mounting Torque: 64 oz-in.  $\pm$  4 oz-in.
10. Supplied with mounting nut and lockwasher - See Filter Design Guide Screw and Locking Washer Table.
11. Insertion Loss for the "C", "L" and "π" circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current. At lower currents the "L" and "π" become much more effective



## METRIC EQUIVALENTS

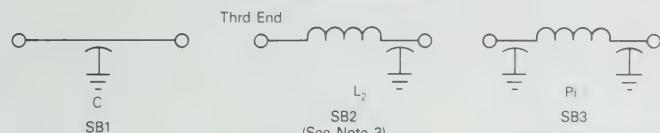
IN	MM	IN	MM
.002	.005	.045	.114
.005	.013	.050	.127
.007	.018	.073	.185
.010	.025	.093	.236
.013	.033	.164	.417
.015	.038	.187	.475
.020	.051	.216	.549
.025	.064	.250	.635
.030	.076	.280	.711
.031	.079	.312	.792
.032	.081	.890	.2261
.040	.102	—	—

(See Note 4)

## NOTES:

1. Nailhead standard. Straight lead available.
2. Lead diameters other than .032" available.
3. All SB2 L Section Filters have inductor (bead) at threaded end.
4. Metric equivalent dimensions given for information only.

## CIRCUIT DIAGRAMS



**BOLT STYLE EMI FILTERS****SB SERIES****8-32 Thread - Epoxy Sealed  
Circuits Available - C, L,  $\pi$** **SPECIFICATIONS**

AVX P/N	CKT	Full Load Insertion Loss Per MIL-STD-220, +25°C										<sup>2</sup> M15733 EQUIV.	<sup>2</sup> M28861 EQUIV.	<sup>3</sup> Rel. Codes
		<sup>1</sup> CAP Voltage	DC Voltage	DCR	1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz				
SB1C1-102	C	1000	50	.01	—	4	20	25	40	50	—	—	—	R B S
SB1C1-502	C	5000	50	.01	—	15	34	41	45	50	—	—	—	R B S
SB1C1-103	C	.01	50	.01	4	21	35	40	55	60	—	—	—	R B S
SB1C1-273	C	.027	50	.01	10	30	39	45	65	70	—	—	—	R B S
SB1C1-503	C	.05	50	.01	15	35	42	50	70	70	—	—	—	R B
SB2C1-273	L2	.027	50	.01	10	30	50	54	65	70	—	/28-0004	—	R B S
SB2C1-503	L2	.05	50	.01	15	36	54	60	70	70	—	—	—	R B
SB3C1-323	$\pi$	.032	50	.01	12	30	60	70	70	70	—	—	/7-002	R B
SB1A1-102	C	1000	100	.01	—	4	20	25	40	50	—	—	—	R B S
SB1A1-502	C	5000	100	.01	—	15	34	41	45	50	—	—	—	R B S
SB1A1-103	C	.01	100	.01	4	21	35	40	55	60	—	—	/7-003	R B S
SB1A1-273	C	.027	100	.01	10	30	39	45	65	70	—	—	/7-005	R B S
SB1A1-503	C	.05	100	.01	15	35	42	50	70	70	—	—	/7-001	R
SB2A1-103	L2	.01	100	.01	4	21	35	38	65	70	—	—	—	R B S
SB2A1-273	L2	.027	100	.01	10	30	50	54	70	70	—	/61-0013	—	R B S
SB3A1-152	$\pi$	1500	100	.01	—	8	20	45	70	70	—	/28-0001	—	R B S
SB3A1-123	$\pi$	.012	100	.01	—	12	60	70	70	70	—	—	/7-004	R B S
SB3A1-153	$\pi$	.015	100	.01	—	17	37	43	70	70	—	/28-0003	—	R B
SB1B1-102	C	1000	200	.01	—	4	20	25	40	50	—	—	/7-006	R B S
SB1B1-502	C	5000	200	.01	—	15	34	41	50	55	—	—	/7-008	R B S
SB2B1-102	L2	1000	200	.01	—	4	20	27	45	70	—	—	—	R B S
SB2B1-502	L2	5000	200	.01	—	15	35	41	55	70	—	—	—	R B S
SB3B1-202	$\pi$	2000	200	.01	—	8	42	58	70	70	—	—	/7-007	R B S

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



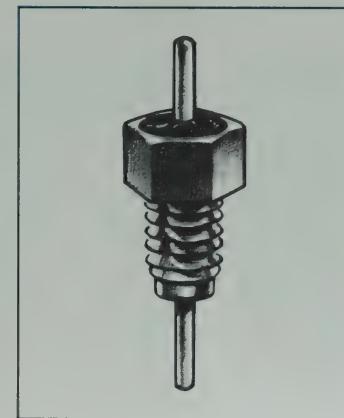
## APPLICATIONS

The SH series provides intermediate filtering in the RF through MICROWAVE frequency spectrums from 100 KHz through 10 GHz. The larger hex size means that much higher values of capacitance are available in the feedthru style circuits and that a 125 VAC/400 Hz rating is available in certain values. Also designed for mounting in a tapped bulkhead or with the standard nut and lockwasher provided, it is optimum in medium to low impedance circuits where significant amounts of capacitance to ground can be tolerated. In the "L" and " $\pi$ " section versions an internal ferrite bead element provides both inductance and series

resistance (lossy characteristic) which improves the insertion loss rolloff to 40 dB and 60 dB per decade respectively. Alternate lead diameters or lengths are available, both with and without a nailhead.

## CHARACTERISTICS

- Equivalent to SB series  $\pi$  circuits and to SP series feedthru or "L" circuits.
- Conservatively rated for 125 VAC/400 Hz in certain values.
- $\pi$  design offers steeper insertion loss rolloff.
- Features rugged monolithic discoidal capacitor construction.
- Epoxy seal on both ends.



## SPECIFICATIONS

1. Plating: Silver standard - Electro-tin or gold available
2. Material:
  - Case: Cold rolled steel standard, brass available
  - Leads: Half/hard copper
3. Operating Temperature Range: -55°C to +125°C
4. Insulation Resistance:
  - At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less
  - At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less
5. Dielectric Withstanding Voltage (DWV):
  - R-level designs: 2.0 times rated DC voltage
  - Class B, Class S designs: 2.5 times rated DC voltage
6. DC Resistance (DCR): 0.1 ohm, maximum
7. Dissipation Factor (DF): 3% maximum
8. Rated DC Current: 10 Amps, maximum
9. Recommended Mounting Torque: 64 oz-in.  $\pm$  4 oz-in.
10. Supplied with mounting nut and lockwasher - See Filter Design Guide Screw and Locking Washer Table.
11. Insertion Loss for the "C", "L" and " $\pi$ " circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current. At lower currents the "L" and " $\pi$ " become much more effective

**STANDARD CONFIGURATION**

(Std. - See Note 1)

**METRIC EQUIVALENTS**

IN	MM	IN	MM
.002	.005	.140	3.56
.004	.010	.190	4.83
.005	.013	.228	5.79
.015	.038	.234	5.94
.020	.051	.328	8.33
.031	.079	.421	10.69
.032	.081	—	—

(See Note 3)

**NOTES:**

1. Nailhead standard, straight lead available.
2. All SH2 L Section Filters have inductor (bead) at threaded end.
3. Metric equivalent dimensions given for information only.

**CIRCUIT DIAGRAMS**

SH1

SH2  
(See Note 2)

SH3



BOLT STYLE EMI FILTERS

SH SERIES

10-32 Thread - Epoxy Sealed  
Circuits Available - C, L,  $\pi$ 

## SPECIFICATIONS

AVX P/N	CKT	'CAP	DC Voltage	DCR	Full Load Insertion Loss Per MIL-STD-220, +25°C								^M15733 EQUIV.	^M28861 EQUIV.	^Rel. Codes
					1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz	—	—			
SH1C1-124	C	.12	50	.01	21	38	49	60	70	70	—	—	—	—	R B S
SH1C1-204	C	.2	50	.01	28	39	52	60	70	70	—	—	—	—	R B
SH2C1-124	L2	.12	50	.01	21	38	52	70	70	70	—	—	—	—	R B S
SH2C1-204	L2	.2	50	.01	28	39	54	70	70	70	—	—	—	—	R B
SH3C1-303	$\pi$	.03	50	.01	10	28	58	70	70	70	—	—	—	—	R B S
SH1A1-503	C	.05	100	.01	15	35	42	50	70	70	—	—	—	—	R B S
SH1A1-104	C	.1	100	.01	20	38	48	53	70	70	—	—	—	—	R B S
SH2A1-503	L2	.05	100	.01	15	36	50	60	70	70	—	—	—	—	R B S
SH2A1-104	L2	.1	100	.01	20	39	52	65	70	70	—	—	—	—	R B S
SH3A1-123	$\pi$	.012	100	.01	—	12	60	70	70	70	—	—	—	—	R B S
SH1L1-102	C	1000	200*	.01	—	4	20	25	40	50	—	—	—	—	R B S
SH1L1-502	C	5000	200*	.01	—	15	34	41	45	55	—	—	—	—	R B S
SH1L1-103	C	.01	200*	.01	4	21	35	38	60	65	—	—	—	—	R B S
SH1L1-253	C	.025	200*	.01	8	28	36	44	64	70	—	—	—	—	R B
SH2L1-102	L2	1000	200*	.01	—	4	20	27	45	55	—	—	—	—	R B S
SH2L1-502	L2	5000	200*	.01	—	15	35	41	55	65	—	—	—	—	R B S
SH2L1-103	L2	.01	200*	.01	4	21	36	40	60	65	—	—	—	—	R B S
SH3B1-202	$\pi$	2000	200*	.01	—	8	42	58	70	70	—	—	—	—	R B S

\*Rated 200 VDC or 125 VAC/400 Hz

^Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

^Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

^See Filter Design Guide, Reliability Levels.

5  
6



## BOLT STYLE EMI FILTERS

# SP SERIES

12-32 Thread - Epoxy Sealed  
Circuits Available - C, L,  $\pi$

## APPLICATIONS

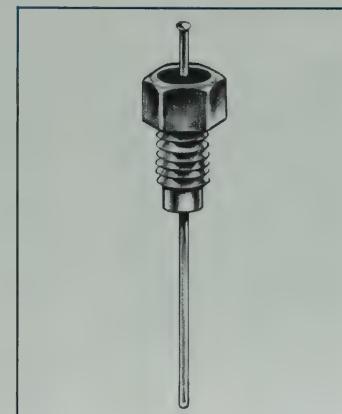
The SP series provides increased filtering in the HF through MICRO-WAVE frequency spectrums from 100 KHz through 10 GHz. The larger hex size means that much higher values of capacitance are available and that a 125 VAC/400 Hz rating is available in certain values. Also designed for mounting in a tapped bulkhead or with the standard nut and lock-washer provided, it is optimum in medium to low impedance circuits where significant amounts of capacitance to ground can be tolerated. In the "L" and " $\pi$ " section versions an internal ferrite bead element provides both inductance

and series resistance (lossy characteristic) which improves the insertion loss rolloff to 40 dB and 60 dB per decade respectively.

Alternate lead diameters or lengths are available both with and without a nailhead.

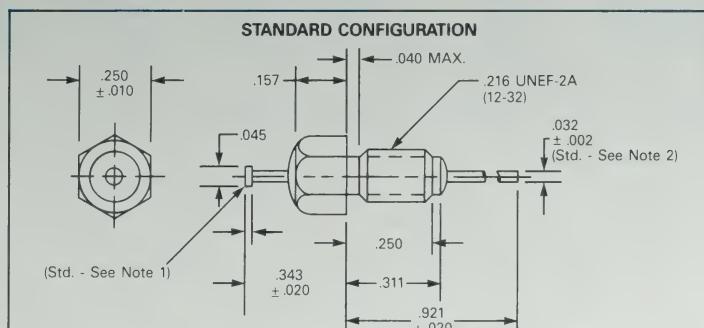
## CHARACTERISTICS

- Designed to meet or exceed the applicable portions of MIL-F-28861/9. See QPL listing.
- Conservatively rated for 125 VAC/400 Hz in certain values.
- $\pi$  design offers steeper insertion loss rolloff.
- Features rugged monolithic discoidal capacitor construction.
- Epoxy seal on both ends.



## SPECIFICATIONS

1. Plating: Silver standard - Electro-tin or gold available
2. Material:
  - Case: Cold rolled steel standard, brass available
  - Leads: Half/hard copper
3. Operating Temperature Range: -55°C to +125°C
4. Insulation Resistance:
  - At 25°C: 1000 megohm-microfarad min., or 10,000 megohms min., whichever is less
  - At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less
5. Dielectric Withstanding Voltage (DWV):
  - R-level designs: 2.0 times rated DC voltage
  - Class B, Class S designs: 2.5 times rated DC voltage
6. DC Resistance (DCR): .01 ohm, maximum
7. Dissipation Factor (DF): 3% maximum
8. Rated DC Current: 10 amps, maximum
9. Recommended mounting torque: 64 oz-in.  $\pm$  4 oz-in.
10. Supplied with mounting nut and lockwasher - See Filter Design Guide Screw and Locking Washer Table.
11. Insertion Loss for the "C", "L" and " $\pi$ " circuits are equivalent due to the saturation characteristic of the ferrite bead element at full rated current. At lower currents the "L" and " $\pi$ " become much more effective



### METRIC EQUIVALENTS

IN	MM	IN	MM
.002	.005	.093	2.36
.005	.013	.157	3.99
.007	.018	.187	4.75
.010	.025	.216	5.49
.020	.051	.241	6.12
.023	.058	.250	6.35
.031	.079	.311	7.90
.032	.081	.343	8.71
.040	.102	.372	9.45
.045	.114	.383	9.73
.063	.160	.921	23.39
.073	.185	—	—

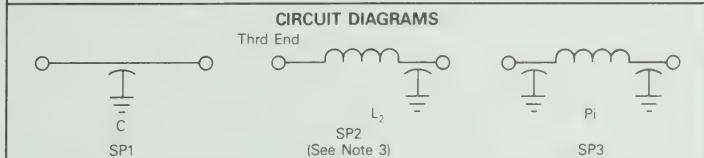
(See Note 4)

### NOTES:

1. Nailhead standard, straight lead available
2. Lead diameters other than .032" available.
3. SP2 L Section Filters have inductor (bead at threaded end).
4. Metric equivalent dimensions given for information only.

5

Small-hex version may be specified for selected capacitance/voltage ratings. Contact AVX Filters Engineering for availability





## BOLT STYLE EMI FILTERS

## SP SERIES

12-32 Thread - Epoxy Sealed  
Circuits Available - C, L,  $\pi$ 

## SPECIFICATIONS

AVX P/N	CKT	'CAP	DC Voltage	DCR	Full Load Insertion Loss Per MIL-STD-220, +25°C							<sup>2</sup> M15733 EQUIV.	<sup>2</sup> M28861 EQUIV.	<sup>3</sup> Rel. Codes
					1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz				
SP1C1-204	C	.20	50	.01	26	39	52	60	70	70	—	—	/9-002	R B
SP2C1-204	L2	.20	50	.01	26	38	65	70	70	70	—	—	—	R B
SP3C1-124	$\pi$	.12	50	.01	20	38	70	70	70	70	—	—	/9-001	R B
SP1A1-503	C	.05	100	.01	15	35	38	50	70	70	—	—	/9-003	R B S
SP1A1-104	C	.10	100	.01	20	38	48	53	70	70	—	—	/9-004	R B S
SP2A1-503	L2	.05	100	.01	15	36	54	60	70	70	—	—	—	R B S
SP3A1-753	$\pi$	.075	100	.01	18	38	70	70	70	70	—	—	/9-005	R B
SP1L1-102	C	1000	200*	.01	—	4	20	25	40	50	—	—	/9-006	R B S
SP1L1-502	C	5000	200*	.01	—	15	34	41	50	55	—	—	/9-007	R B S
SP1L1-103	C	.01	200*	.01	4	21	35	40	55	60	—	—	/9-008	R B S
SP1L1-253	C	.025	200*	.01	8	28	36	44	64	70	—	—	/9-010	R B S
SP2L1-102	L2	1000	200*	.01	—	4	20	27	45	70	—	—	—	R B S
SP2L1-502	L2	5000	200*	.01	—	15	35	41	55	70	—	—	—	R B S
SP2L1-103	L2	.01	200*	.01	4	21	35	38	65	70	—	—	—	R B S
SP3B1-152	$\pi$	1500	200	.01	—	8	20	45	70	70	—	/61-0002	—	R B S
SP3B1-123	$\pi$	.012	200	.01	—	12	60	70	70	70	—	—	/9-009	R B S

<sup>1</sup>Rated 200 VDC or 125 VAC/400 Hz<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



## APPLICATIONS

The SN series offers effective filtering from 1 MHz to 10 GHz. Glass sealed on both ends for hermeticity, this series is impervious to high moisture, solvents, or other severe environmental conditions commonly encountered in military applications. It is designed for bulkhead mounting with nut and lockwasher supplied.

The feedthru designs yield constant filtering as current level is increased from no-load to full rated load. They are most effective when placed in high impedance circuits. The  $\pi$ -section designs exhibit sharper roll-off in filter characteristic and perform effectively when used in medium to low impedance circuits.

Alternate lead configurations or special capacitance values and voltage ratings may be ordered.

## CHARACTERISTICS

- The hermetic bolt-style design was developed to meet or exceed the applicable portions of MIL-F-28861/10. The filter is assembled with a glass hermetic seal on both ends. The rugged monolithic capacitor element is a low inductance design that yields superior bypass performance. The  $\pi$ -section design contains two capacitor elements together with a ferrite bead inductor.
- Certain feedthru designs are rated for 115 VAC/400 Hz applications. The 200 VDC  $\pi$ -section design is rated for DC applications only.



## SPECIFICATIONS

1. Plating: Silver standard - Electro-tin or gold available

2. Material:

Case: Cold rolled steel standard - Brass available

Leads: Copper nailhead standard. Only available in .032" diameter. Beryllium copper lead available. Straight lead available.

3. Operating Temperature Range: -55°C to +125°C

4. Electrical Characteristics:

A. Capacitance: Guaranteed Minimum Value (GMV) as listed

B. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 100,000 megohms min., whichever is less

At 125°C: 100 megohm-microfarad min., or 10,000 megohms min., whichever is less

C. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated voltage

Class B, Class S designs:

2.5 times rated voltage

D. DC Resistance (DCR): .01 ohm, maximum

E. Voltage Drop: 0.1 volt, maximum

F. Dissipation Factor (DF): 3%

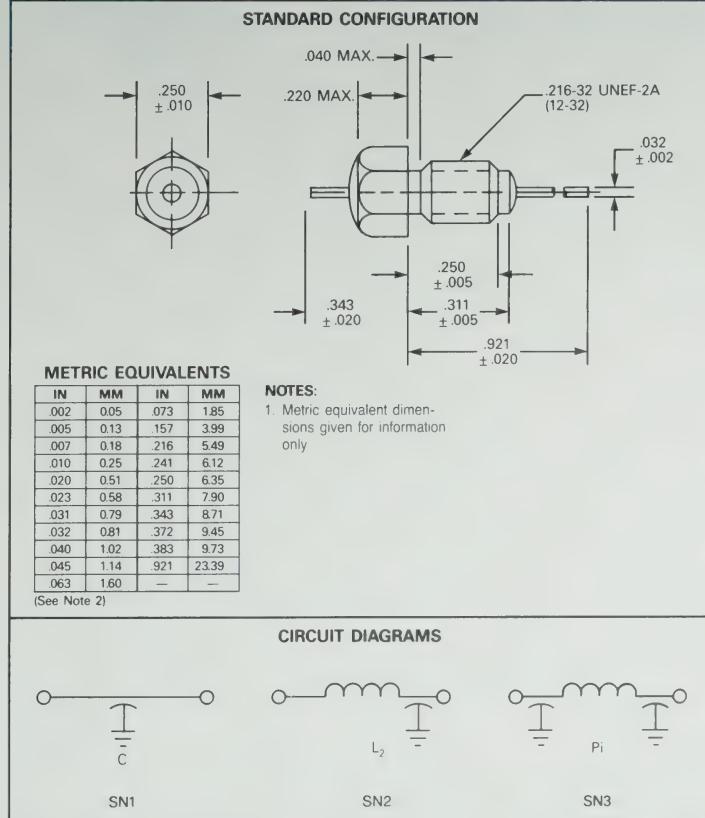
maximum

G. Rated Current: 10 Amps, maximum

5. Seal: In accordance with MIL-F-28861. Leakage rate for Class S designs shall not exceed  $1 \times 10^{-7}$  atm cc/sec.

6. Marking: Standard (AVX symbol, AVX part number)

7. Installation: Filter is supplied with mounting nut and lockwasher. The recommended mounting torque is 64 oz-in.  $\pm$  4 oz-in. Refer to the "Installation and Handling" section for additional information



**BOLT STYLE EMI FILTERS****SN SERIES**12-32 Thread - Hermetically Sealed  
Circuits Available - C, L,  $\pi$ **SPECIFICATIONS**

AVX P/N	CKT	Full Load Insertion Loss Per MIL-STD-220, +25°C										M15733 EQUIV.	M28861 EQUIV.	Rel. Codes
		'CAP	Voltage	DCR	1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz				
SN1C1-204	C	.20	50	.01	26	39	52	60	70	70	—	—	/10-002	R B
SN2C1-204	L2	.20	50	.01	26	38	65	70	70	70	—	—	—	R B
SN3C1-124	$\pi$	.12	50	.01	20	38	70	70	70	70	—	—	/10-001	R B
SN1A1-503	C	.05	100	.01	15	35	42	50	70	70	—	—	/10-003	R B S
SN1A1-104	C	.10	100	.01	20	38	48	53	70	70	—	—	/10-004	R B S
SN2A1-503	L2	.05	100	.01	15	36	54	60	70	70	—	—	—	R B S
SN3A1-753	$\pi$	.075	100	.01	18	38	70	70	70	70	—	—	/10-005	R B
SN1L1-102	C	1000	200*	.01	—	4	20	25	40	50	—	—	/10-006	R B S
SN1L1-502	C	5000	200*	.01	—	15	34	41	50	55	—	—	/10-007	R B S
SN1L1-103	C	.01	200*	.01	4	21	35	40	55	60	—	—	/10-008	R B S
SN1L1-253	C	.025	200*	.01	8	28	36	44	64	70	—	—	/10-010	R B S
SN2L1-102	L2	1000	200*	.01	—	4	20	27	45	70	—	—	—	R B S
SN2L1-502	L2	5000	200*	.01	—	15	35	41	55	70	—	—	—	R B S
SN2L1-103	L2	.01	200*	.01	4	21	35	38	65	70	—	—	—	R B S
SN3B1-152	$\pi$	1500	200	.01	—	8	20	45	70	70	—	—	—	R B S
SN3B1-123	$\pi$	.012	200	.01	—	12	60	70	70	70	—	—	/10-009	R B S

\*Rated 200 VDC or 125 VAC/400 Hz

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.5  
10

# CYLINDRICAL STYLE

## Cylindrical Style EMI Filters Series

- BL Epoxy Seal-Button .375 Dia.
- BK Herm Seal-Button .375/.410 Dia.
- CK Herm Seal .375 Dia.
- GK Herm Seal .375/.410 Dia.
- JD Herm Seal .690 Dia.







## APPLICATIONS

The BL series offers effective filtering from 30 KHz up through 1 GHz. It offers epoxy resin seals on both ends in order to optimize volumetric efficiency and reduce cost. Where severe moisture environments exist the slightly larger companion BK series is recommended as it incorporates a glass to metal hermetic seal at both ends. The BL series is designed for bulkhead mounting in a slotted hole with nut and lockwasher supplied. This series is ideal for low to medium impedance circuits where large amounts of capacitance to ground can be tolerated. In the "L" section version an internal ferrite bead element provides

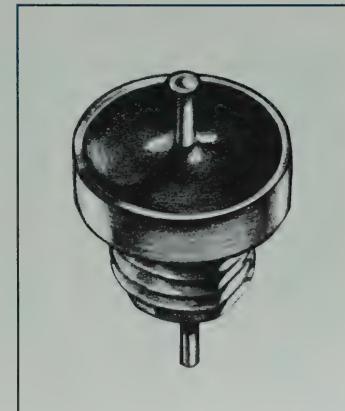
both inductance and series resistance (lossy characteristic) which improves insertion loss at lower current ratings and provides superior transient performance.

Alternate lead configurations or special capacitance values may be ordered.

Custom packages or filter arrays utilizing the BL series can be furnished.

## CHARACTERISTICS

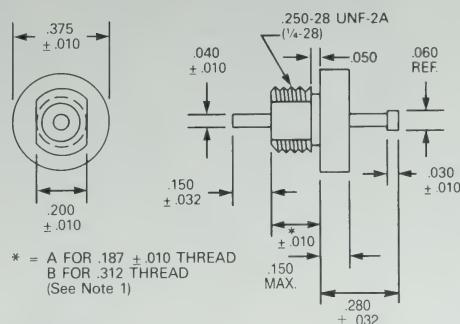
- Internal ferrite bead provides inductance for the L-section version.
- High DC current rating: 15 Amps.



## SPECIFICATIONS

1. Case/Terminal Plating: Electro-tin standard - Gold or silver available
2. Material:
  - Case: Brass standard - Steel available
  - End Seal: Epoxy
  - Terminals: Copper nailhead standard
3. Operating Temperature Range: -55°C to +125°C
4. Electrical Characteristics:
  - A. Rated Voltage: See chart
  - B. Insulation Resistance:
    - At 25°C: 1,000 megohm-microfarad min., or 50,000 megohms, whichever is less, at the rated DC voltage
    - At 125°C: 100 megohm-microfarad min., or 5,000 megohms min., whichever is less
  - C. Dielectric Withstanding Voltage (DWV):
    - R-level designs: 2.0 times rated DC voltage
    - Class B designs: 2.5 times rated DC voltage
  - D. Capacitance:
    - Values listed in chart are "guaranteed minimum value" (GMV)
5. Marking:
  - Standard Marking: AVX, AVX part number, lot code.
  - BL2 only: Letter "L" denotes ferrite bead inductor at threaded end
  - See Reliability Codes section for definition of Reliability Level marking. See How to Order section for part number construction.
6. Installation:
  - A. Mounting Torque: 44 oz-in.  $\pm$  4 oz-in.
  - B. Refer to "Installation, Handling, Hardware Options" section of the catalog

### STANDARD CONFIGURATION



### METRIC EQUIVALENTS

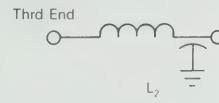
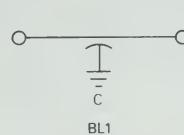
IN	MM	IN	MM
.010	.25	.100	2.54
.030	.76	.150	3.81
.032	.81	.180	4.57
.040	1.02	.200	5.08
.060	1.52	.375	9.53

(See Note 2)

### NOTES:

1. All BL2 L Section Filters have inductor (bead) at threaded end.
2. Metric equivalent dimensions given for information only.

### CIRCUIT DIAGRAMS





## CYLINDRICAL STYLE EMI FILTERS

## BL SERIES

Button - Epoxy Sealed  
Circuits Available - C & L

.375 DIA.

## SPECIFICATIONS

15 AMP DC  
DCR .008 OHM

AVX P/N	CKT	'CAP	DC Voltage	Full Load Insertion Loss Per MIL-STD-220, +25°C							<sup>2</sup> M15733 EQUIV.	<sup>2</sup> M28861 EQUIV.	<sup>3</sup> Rel. Codes
				30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
BL1CA-754	C	.75	50	11	20	26	37	43	62	70	—	—	— R B
BL1CA-105	C	1.0	50	12	21	27	40	48	64	70	—	—	— R B
BL1CA-125	C	1.2	50	12	22	29	40	51	70	70	—	—	— R B
BL1CA-145	C	1.4	50	12	24	30	40	53	70	70	—	—	— R
BL2CA-754	L2	.75	50	11	20	26	40	44	64	70	—	—	— R B
BL2CA-105	L2	1.0	50	12	20	27	40	50	65	70	—	—	— R B
BL2CA-125	L2	1.2	50	12	22	29	40	51	70	70	—	—	— R B
BL2CA-145	L2	1.4	50	12	27	32	40	55	70	70	—	—	— R
BL1AA-504	C	.50	100	—	16	21	34	42	58	70	—	—	— R B
BL1AA-754	C	.75	100	11	20	26	37	43	62	70	—	—	— R
BL1AA-105	C	1.0	100	12	21	27	40	48	64	70	—	—	— R
BL1AA-125	C	1.2	100	12	22	29	40	51	70	70	—	—	— R
BL2AA-504	L2	.50	100	—	16	21	36	44	60	70	—	—	— R B
BL2AA-754	L2	.75	100	11	20	26	40	44	64	70	—	—	— R
BL2AA-105	L2	1.0	100	12	20	27	40	50	65	70	—	—	— R
BL2AA-125	L2	1.2	100	12	22	29	40	51	70	70	—	—	— R
BL1BA-103	C	.01	200	—	—	—	4	21	30	53	—	—	— R B
BL1LA-753	C	.075	200*	—	—	7	18	37	46	70	—	—	— R B
BL1LA-154	C	.15	200*	—	7	13	24	38	50	70	—	—	— R B
BL2BA-103	L2	.01	200	—	—	—	4	21	30	53	—	—	— R B
BL2LA-753	L2	.075	200*	—	—	7	18	37	51	70	—	—	— R B
BL2LA-154	L2	.15	200*	—	7	13	26	40	53	70	—	—	— R B

\* Also rated 125 VAC/400 Hz

<sup>1</sup> Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup> Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup> See Filter Design Guide, Reliability Levels.6  
2



## APPLICATIONS

The BK series offers effective filtering from 500 KHz to 10 GHz. Glass sealed for hermeticity, this low profile series is impervious to high moisture, solvents, or other severe environmental conditions commonly encountered in military applications. It is designed for bulkhead mounting in a slotted hole with nut and lockwasher supplied. This series is ideal for low to medium impedance circuits where large amounts of capacitance to ground can be tolerated. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and

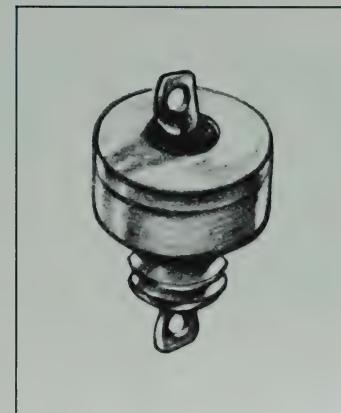
provides superior transient performance.

Alternate lead configurations or special capacitance values may be ordered.

Custom packages or filter arrays utilizing the BK series can be furnished.

## CHARACTERISTICS

- Meets or exceeds the applicable requirements of MIL-F-28861/1. See QPL listings.
- Glass hermetict-seal on both ends.
- Internal ferrite bead provides inductance for the L-section version.
- High DC current rating: 15 Amps.



## SPECIFICATIONS

1. Case/Terminal Plating: Electro-tin standard - Silver or gold available

2. Material:

Case: Brass standard -  
Steel available

End seal: Mild steel

Terminals: Nickel-iron alloy

3. Operating Temperature Range:  
-55°C to +125°C

4. Electrical Characteristics:

A. Rated Voltage - See chart

B. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 50,000 megohms, whichever is less, at the rated DC voltage

At 125°C: 100 megohm-microfarad min., or 5,000 megohms, whichever is less

C. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

D. Capacitance:

Values listed in chart are "guaranteed minimum value" (GMV)

5. Marking:

Standard Marking: AVX, AVX part number, lot code

BK2 only: Letter "L" denotes ferrite bead inductor at threaded end

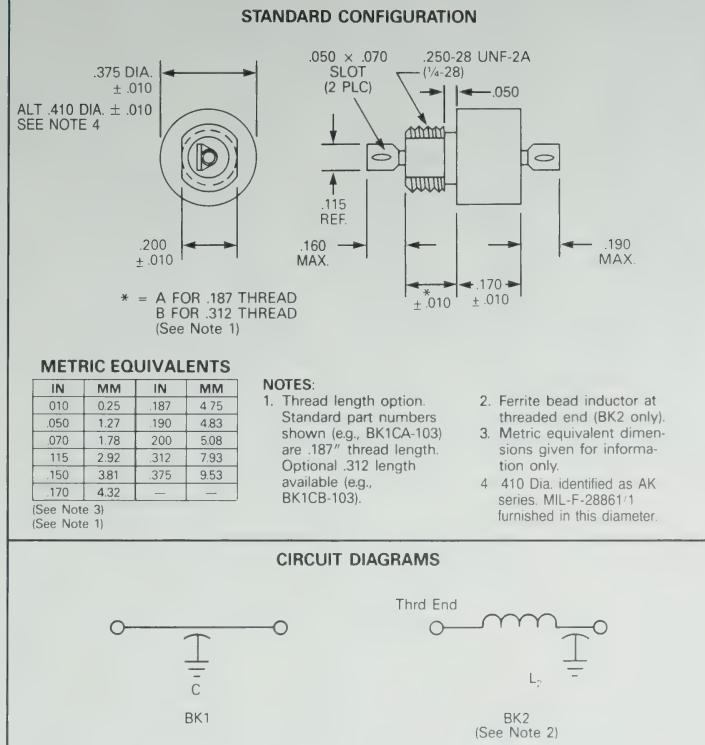
See Reliability Codes section for definition of Reliability Level marking. See How to Order section for part number construction.

6. Installation:

A. Mounting Torque:

44 oz-in. ± 4 oz-in.

B. Refer to "Installation, Handling, Hardware Options" section of the catalog





## CYLINDRICAL STYLE EMI FILTERS

## BK SERIES

Button - Hermetically Sealed  
Circuits Available - C & L

.375/.410 DIA.

## SPECIFICATIONS

15 AMP DC  
DCR .008 OHM

AVX P/N	CKT	'CAP	DC Voltage	Full Load Insertion Loss Per MIL-STD-220, +25°C								^M15733 EQUIV.	^M28861 EQUIV.	^Rel. Codes
				30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz				
BK1CA-125	C	1.2	50	15	28	33	40	40	70	70	—	—	/01-002	R B
BK1CB-125	C	1.2	50	15	28	33	40	40	70	70	—	—	/01-012	R B
BK2CA-125	L2	1.2	50	15	28	33	40	40	70	70	—	/38-0002	/01-001	R B
BK2CB-125	L2	1.2	50	15	28	33	40	40	70	70	—	/38-0006	/01-011	R B
BK1NA-704	C	.7	70	10	24	30	40	40	64	70	—	—	/01-004	R B S
BK1NB-704	C	.7	70	10	24	30	40	40	64	70	—	—	/01-014	R B S
BK2NA-704	L2	.7	70	10	24	30	40	40	64	70	—	—	/01-003	R B S
BK2NB-704	L2	.7	70	10	24	30	40	40	64	70	—	—	/01-013	R B S
BK1AA-103	C	.01	100	—	—	—	4	21	30	53	—	—	—	R B S
BK1AA-454	C	.45	100	6	19	25	36	40	60	70	—	—	/01-006	R B S
BK1AB-454	C	.45	100	6	19	25	36	40	60	70	—	—	/01-016	R B S
BK1AA-754	C	.75	100	11	24	30	40	41	64	70	—	—	—	R B
BK1AA-105	C	1.0	100	12	26	32	41	48	64	70	—	—	—	R
BK2AA-454	L2	.45	100	6	19	25	36	40	60	70	—	—	/01-005	R B S
BK2AB-454	L2	.45	100	6	19	25	36	40	60	70	—	—	/01-015	R B S
BK2AA-754	L2	.75	100	11	24	30	40	41	64	70	—	—	—	R B
BK2AA-105	L2	1.0	100	12	26	32	41	50	65	70	—	—	—	R
BK1HA-254	C	.25	150	—	14	20	31	40	56	70	—	—	/01-008	R B S
BK1HB-254	C	.25	150	—	14	20	31	40	56	70	—	—	/01-018	R B S
BK2HA-254	L2	.25	150	—	14	20	31	40	56	70	—	—	/01-007	R B S
BK2HB-254	L2	.25	150	—	14	20	31	40	56	70	—	—	/01-017	R B S
BK1LA-753	C	.075	200*	—	—	7	18	37	46	70	—	—	—	R B S
BK1LA-154	C	.15	200*	—	10	16	26	40	52	70	—	/49-0009	/01-010	R B S
BK1LB-154	C	.15	200*	—	10	16	26	40	52	70	—	—	/01-020	R B S
BK2BA-203	L2	.02	200*	—	—	—	7	25	35	60	—	/38-0008	—	R B S
BK2LA-753	L2	.075	200*	—	—	7	18	37	51	70	—	—	—	R B S
BK2LA-154	L2	.15	200*	—	10	16	26	40	52	70	—	—	/01-009	R B S
BK2LB-154	L2	.15	200*	—	10	16	26	40	52	70	—	—	/01-019	R B S

\*Also rated 125 VAC/400 Hz

^Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

^Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

^See Filter Design Guide, Reliability Levels.



## APPLICATIONS

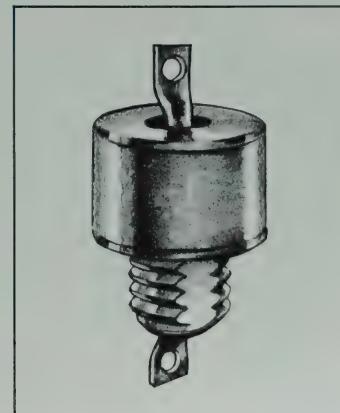
The CK series offers effective filtering from 100 KHz to 10 GHz. Glass sealed for hermeticity, this medium profile series is impervious to high moisture, solvents, or other severe environmental conditions commonly encountered in military applications. It is designed for bulkhead mounting in a slotted hole with nut and lockwasher supplied. This series is ideal for low to medium impedance circuits where large amounts of capacitance to ground can be tolerated. In the "L" section version an internal ferrite bead element provides both inductance and series resistance (lossy characteristic) which improves insertion loss and provides superior transient performance.

Alternate lead configurations or special capacitance values may be ordered.

Custom packages or filter arrays utilizing the CK series can be furnished.

## CHARACTERISTICS

- Meets or exceeds the applicable requirements of MIL-F-15733, and the environmental/test requirements of MIL-F-28861.
- Glass hermetic-seal on both ends.
- Internal ferrite bead provides inductance for the L-section version.
- High DC current rating: 15 Amps.
- High capacitance values available.
- Conservatively rated for 125 VAC/400 Hz in certain values.



## SPECIFICATIONS

1. Case/Terminal Plating: Electro-tin standard - Silver or gold available

2. Material:

Case: Brass standard - Steel available

End Seal: Mild steel

Terminals: Nickel-iron alloy

3. Operating Temperature Range: -55°C to +125°C

4. Electrical Characteristics:

A. Rated Voltage - See chart

B. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 50,000 megohms, whichever is less, at the rated DC voltage

At 125°C: 100 megohm-microfarad min., or 5,000 megohms, whichever is less

C. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

D. Capacitance: Values listed in chart are "guaranteed minimum value" (GMV)

E. Marking:

Standard Marking: AVX, AVX part number, rated current, voltage, lot code

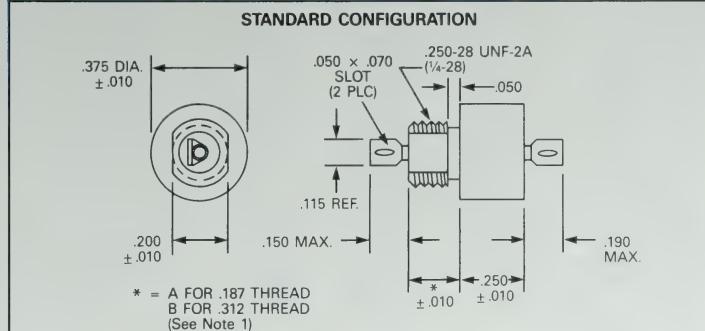
B. CK2 only: Letter "L" to denote ferrite bead inductor at threaded end

C. See Reliability Codes section for definition of Reliability Level marking. See How to Order section for part number construction.

6. Installation:

A. Mounting Torque: 44 oz-in.  $\pm$  4 oz-in.

B. Refer to "Installation, Handling, Hardware Options" section of the catalog



### METRIC EQUIVALENTS

IN	MM	IN	MM
.010	.25	.190	4.83
.050	1.27	.200	5.08
.070	1.78	.250	6.35
.115	2.92	.312	7.93
.150	3.81	.375	9.53
.187	4.75	—	—

(See Note 3)

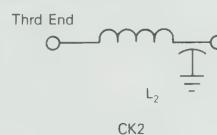
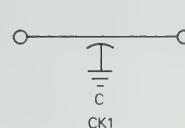
### NOTES:

1. Thread length option.  
EXAMPLE: CK1CA-103 (.187 thrd. L) CK1CB-103 (.312 thrd. L)

2. All CK2 L Section Filters have inductor (bead) at threaded end.

3. Metric equivalent dimensions given for information only.

### CIRCUIT DIAGRAMS





## CYLINDRICAL STYLE EMI FILTERS

## CK SERIES

Button - Hermetically Sealed  
Circuits Available - C & L

.375 DIA.

## SPECIFICATIONS

15 AMP DC  
DCR .008 OHM

AVX P/N	Current AMP	CKT	'CAP	DC Voltage	Full Load Insertion Loss Per MIL-STD-220, +25°C								^M15733 EQUIV.	^Rel. Codes
					30 KHz	150 KHz	500 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
CK1CA-754	15	C	.75	50	6	20	31	37	43	62	70	—	—	R B S
CK1CA-105	15	C	1.0	50	7	21	31	40	48	64	70	—	—	R B
CK1CA-145	15	C	1.4	50	9	24	34	40	53	70	70	—	—	R
CK1CA-205	15	C	2.0	50	12	26	37	43	60	70	70	—	—	R
CK2CA-754	15	L2	.75	50	6	20	31	40	44	64	70	—	—	R B S
CK2CA-105	15	L2	1.0	50	7	20	31	40	50	65	70	—	—	R B
CK2CA-145	15	L2	1.4	50	9	28	34	40	55	70	70	/58-0001	—	R
CK2CA-205	15	L2	2.0	50	12	27	37	43	60	70	70	—	—	R
CK1AA-504	15	C	.5	100	—	16	26	34	42	58	70	—	—	R B S
CK1AA-754	15	C	.75	100	6	20	31	37	43	62	70	—	—	R B
CK1AA-105	15	C	1.0	100	7	21	40	40	48	64	70	—	—	R
CK1AA-185	15	C	1.8	100	9	24	35	41	55	70	70	—	—	R
CK2AA-504	15	L2	.5	100	—	16	26	36	44	60	70	—	—	R B S
CK2AA-754	15	L2	.75	100	6	20	31	40	44	64	70	—	—	R B
CK2AA-105	15	L2	1.0	100	7	21	31	41	50	65	70	—	—	R
CK2AA-185	15	L2	1.8	100	9	24	35	41	55	70	70	—	—	R
CK1BA-103	15	C	.01	200	—	—	—	4	21	33	53	—	—	R B S
CK1LA-753	15	C	.075	200*	—	—	12	18	37	46	70	—	—	R B S
CK1BA-104	15	C	.1	200	—	—	14	20	38	55	70	—	—	R B S
CK1LA-154	15	C	.15	200*	—	7	17	24	38	50	70	—	—	R B S
CK1BA-304	15	C	.3	200	—	13	23	32	44	65	70	—	—	R
CK1BA-504	15	C	.5	200	—	16	26	34	42	58	70	—	—	R
CK2BA-103	15	L2	.01	200	—	—	—	4	21	30	55	—	—	R B S
CK2LA-753	15	L2	.075	200*	—	—	12	18	37	51	70	—	—	R B S
CK2BA-104	15	L2	.1	200	—	—	14	20	39	50	70	—	—	R B S
CK2LA-154	15	L2	.15	200*	—	7	17	26	40	53	70	—	—	R B S
CK2BA-304	15	L2	.3	200	—	13	23	32	44	65	70	—	—	R
CK2BA-504	15	L2	.5	200	—	16	26	36	44	60	70	—	—	R

\*Also rated 125 VAC/400 Hz

^Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

^Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

^See Filter Design Guide, Reliability Levels.



## APPLICATIONS

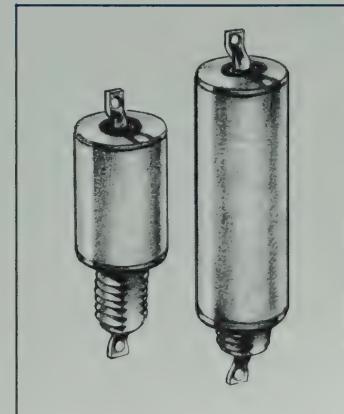
The GK series offers effective filtering from 30 KHz to 10 GHz. Glass sealed for hermeticity, this series is impervious to high moisture, solvents, or other severe environmental conditions commonly encountered in military applications. It is designed for bulkhead mounting in a slotted hole with nut and lockwasher supplied.

Transient voltage suppression devices can be added to any of the GK designs to provide complete circuit protection against EMP, lightning, or voltage spikes such as per MIL-STD-704. These devices when combined with high frequency attenuation characteristics of the discoidal capacitor and toroidal inductors offer significant performance advantages by suppressing and absorbing the EMP pulse over a very broad spectral range. Very high pulse currents will occur within the EMI filter. However, reradiation to sensitive electronic circuits is prevented by the fully-shielded case design. In some designs a slight increase in the case length of the filter is required to provide space for the transient suppression device.

The "L", "T" and 5 element configurations are designed to provide effective attenuation over a wide range of circuit impedances. For current ratings under 10 Amps toroidal wound inductor elements offer increased filter performance and protection against circuit transients. Data showing the actual inductance versus various levels of DC or AC bias current are available as well as the attenuation in any combination of source and load impedances.

Alternate lead configurations or special capacitance/inductance values may be ordered.

Custom packages or filter arrays utilizing the GK series can be furnished.



## CHARACTERISTICS

- Meets or exceeds the applicable requirements of MIL-F-28861/2,3,4,5. See QPL listings.
- Glass hermetic seal on both ends.
- Available with EMP suppression (transient suppression devices)
- Wound toroidal inductor used in current ratings up through 5 Amps. Ferrite bead inductor used in 10 and 15 Amp designs.
- High DC current rating: 15 Amps.
- High capacitance values available.

6  
7

## SPECIFICATIONS

1. Case/Terminal Plating: Electro-tin standard - Silver or gold available

2. Material:

Case: Brass standard - Steel available

End Seal: Mild steel

Terminals: Nickel-iron alloy

3. Operating Temperature Range: -55°C to +125°C

4. Electrical Characteristics:

A. Rated Voltage and Current - See chart

B. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 50,000 megohms, whichever is less, at the rated DC voltage

At 125°C: 100 megohm-microfarad min., or 5,000 megohms, whichever is less

C. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

D. Capacitance:

Total capacitance listed in chart for each filter type is "guaranteed minimum value" (GMV)

5. Marking:

Standard Marking: AVX, AVX part number, rated current, voltage, lot code, schematic

NOTE: Schematic to indicate location of inductor (standard or reverse) for GK2 L section filters

See Reliability Codes section for definition of Reliability Level marking. See How to Order section for part number construction.

6. Installation:

A. Mounting Torque: 44 oz-in.  $\pm$  4 oz-in.

B. Refer to "Installation, Handling, Hardware Options" section of the catalog



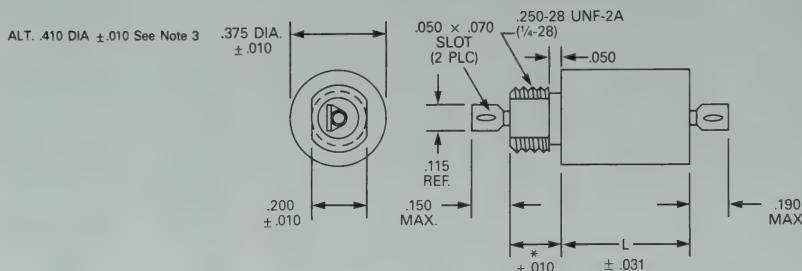
## CYLINDRICAL STYLE EMI FILTERS

## GK SERIES

Hermetically Sealed

Circuits Available - C, L,  $\pi$ , T, 2T .375/.410 DIA.

## STANDARD CONFIGURATION



## METRIC EQUIVALENTS

IN	MM	IN	MM
.010	.25	.187	4.75
.031	.79	.190	4.83
.050	1.27	.200	5.08
.070	1.78	.312	7.93
.115	2.92	.375	9.53
.150	3.81	.540	13.72

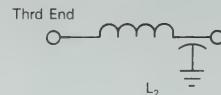
(See Note 2)

## NOTES:

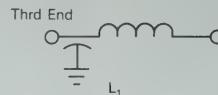
1. Thread length option. Standard part numbers shown (e.g., GK2BA-S02) are .187" thread length. Optional .312 length available (e.g., GK2BB-S02).
2. Metric equivalent dimensions given for information only.
3. All QPL MIL-F-28861 will be supplied with .410 diameter. See applicable slash sheet for mechanical dimensions.

\* = A FOR .187 ±.010 THREAD  
B FOR .312 THREAD  
(See Note 1)

## CIRCUIT DIAGRAMS



GK2 - Standard



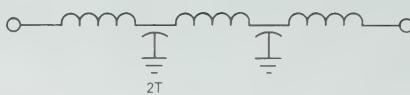
GK2 - Reverse



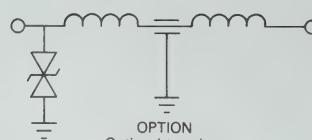
GK3



GK4



GK7



OPTION  
Optional transient  
suppression device



CYLINDRICAL STYLE EMI FILTERS

## GK SERIES

Hermetically Sealed

Circuits Available - L,  $\pi$ , T, 2T

.375/.410 DIA.

## SPECIFICATIONS

50 VDC,  
1.4  $\mu$ F

AVX P/N	Current AMP	CKT	L. dim	DCR	Full Load Insertion Loss Per MIL-STD-220, +25°C								115733 EQUIV.	128861 EQUIV.	2Rel. Codes
					10 KHz	30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
GK2CA-S01	.06	L2	.540	12	16	44	70	70	70	70	70	70	/24-0009	—	R
GK2CA-R01	.06	L1	.540	12	16	44	70	70	70	70	70	70	/24-0017	—	R
GK2CA-S02	.1	L2	.540	10	15	34	62	70	70	70	70	70	/23-0002	—	R
GK2CA-R02	.1	L1	.540	10	15	34	62	70	70	70	70	70	/23-0004	—	R
GK2CA-S03	.15	L2	.540	4	7	24	52	64	70	70	70	70	/24-0010	—	R
GK2CA-R03	.15	L1	.540	4	7	24	52	64	70	70	70	70	/24-0018	—	R
GK2CA-S04	.25	L2	.540	4	6	25	53	65	70	70	70	70	/24-0011	—	R
GK2CA-R04	.25	L1	.540	4	6	25	53	65	70	70	70	70	/24-0019	—	R
GK2CA-S05	.30	L2	.540	0.5	5	16	35	45	66	70	70	70	/24-0001	—	R
GK2CA-R05	.30	L1	.540	0.5	5	16	35	45	66	70	70	70	/24-0003	—	R
GK2CA-S06	.45	L2	.540	0.3	5	15	33	44	65	70	70	70	/24-0012	—	R
GK2CA-R06	.45	L1	.540	0.3	5	15	33	44	65	70	70	70	/24-0020	—	R
GK2CA-S07	.50	L2	.540	1	5	16	41	54	70	70	70	70	/23-0026	—	R
GK2CA-R07	.50	L1	.540	1	5	16	41	54	70	70	70	70	/23-0028	—	R
GK2CA-S08	1.0	L2	.540	.25	5	15	31	42	63	70	70	70	/23-0038	—	R
GK2CA-R08	1.0	L1	.540	.25	5	15	31	42	63	70	70	70	/23-0040	—	R
GK2CA-S09	2.0	L2	.540	.063	5	15	28	35	51	70	70	70	/23-0050	—	R
GK2CA-R09	2.0	L1	.540	.063	5	15	28	35	51	70	70	70	/23-0052	—	R
GK2CA-S10	3.0	L2	.540	.027	5	15	28	34	45	70	70	70	—	—	R
GK2CA-R10	3.0	L1	.540	.027	5	15	28	34	45	70	70	70	—	—	R
GK2CA-S12	10	L2	.540	.008	5	15	28	34	44	52	65	65	/24-0005	—	R
GK2CA-R12	10	L1	.540	.008	5	15	28	34	44	52	65	65	/24-0007	—	R
GK3CA-P02	.1	$\pi$	.540	10	12	44	70	70	70	70	70	70	/23-0006	—	RB
GK3CA-P04	.25	$\pi$	.540	4	8	36	70	70	70	70	70	70	—	—	RB
GK3CA-P07	.5	$\pi$	.540	1	7	24	66	70	70	70	70	70	/23-0030	—	RB
GK3CA-P08	1	$\pi$	.540	.25	5	15	54	70	70	70	70	70	/23-0042	—	RB
GK3CA-P09	2	$\pi$	.540	.063	5	15	40	60	70	70	70	70	/23-0054	—	RB
GK3CA-P10	3	$\pi$	.540	.027	5	15	30	50	70	70	70	70	—	—	RB
GK3CA-P12	10	$\pi$	.540	.008	5	15	28	34	40	52	70	70	—	—	RB
GK4CA-T08	1	T	1.020	.5	5	16	34	56	70	70	70	70	—	—	R
GK4CA-T09	2	T	1.020	.09	5	15	26	37	61	70	70	70	—	—	R
GK4CA-T16	4	T	1.020	.03	5	15	26	34	47	70	70	70	—	—	R
GK4CA-T12	10	T	1.020	.008	5	17	27	34	44	60	70	70	—	—	R
GK7CA-M04	25	2T	1.020	12	30	70	70	70	70	80	80	80	—	—	R
GK7CA-M07	.5	2T	1.020	3	—	53	65	70	70	80	80	80	—	—	R
GK7CA-M08	1	2T	1.020	.75	—	20	55	70	70	80	80	80	—	—	R
GK7CA-M09	2	2T	1.020	.189	—	—	42	62	70	80	80	80	—	—	R
GK7CA-M10	3	2T	1.020	.081	—	—	33	54	70	80	80	80	—	—	R
GK7CA-M12	10	2T	1.020	.008	7	15	29	35	42	70	70	70	—	—	R

<sup>1</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>2</sup>See Filter Design Guide, Reliability Levels.



## CYLINDRICAL STYLE EMI FILTERS

GK SERIES Hermetically Sealed Circuits Available - L,  $\pi$ , T

.375/.410 DIA.

## SPECIFICATIONS

70 VDC,  
.7-1.4  $\mu$ F

AVX P/N	Current AMP	CKT	L. dim	1 <sup>1</sup> CAP	DCR	Full Load Insertion Loss Per MIL-STD-220, + 25°C										2 <sup>1</sup> 5733 EQUIV.	2 <sup>2</sup> 8861 EQUIV.	3 <sup>3</sup> Rel. Codes
						15 KHz	30 KHz	50 KHz	100 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
GK2NA-R02	.1	L1	.540	.7	1.7	9	20	29	41	48	60	70	70	70	70	/23-0004	/04-001	R B S
GK2NB-R02	.1	L1	.540	.7	1.7	9	20	29	41	48	60	70	70	70	70	/23-0003	/04-019	R B S
GK2NA-S02	.1	L2	.540	.7	1.7	9	20	29	41	48	60	70	70	70	70	/23-0002	/04-002	R B S
GK2NB-S02	.1	L2	.540	.7	1.7	9	20	29	41	48	60	70	70	70	70	/23-0001	/04-020	R B S
GK2NA-R05	.3	L1	.540	.7	.77	6	15	23	35	42	54	70	70	70	70	/23-0016	/04-004	R B S
GK2NB-R05	.3	L1	.540	.7	.77	6	15	23	35	42	54	70	70	70	70	/23-0015	/04-022	R B S
GK2NA-S05	.3	L2	.540	.7	.77	6	15	23	35	42	54	70	70	70	70	/23-0014	/04-005	R B S
GK2NB-S05	.3	L2	.540	.7	.77	6	15	23	35	42	54	70	70	70	70	/23-0013	/04-023	R B S
GK2NA-R07	.5	L1	.540	.7	.36	5	12	19	29	36	48	69	70	70	70	/23-0028	/04-007	R B S
GK2NB-R07	.5	L1	.540	.7	.36	5	12	19	29	36	48	69	70	70	70	/23-0027	/04-025	R B S
GK2NA-S07	.5	L2	.540	.7	.36	5	12	19	29	36	48	69	70	70	70	/23-0026	/04-008	R B S
GK2NB-S07	.5	L2	.540	.7	.36	5	12	19	29	36	48	69	70	70	70	/23-0025	/04-026	R B S
GK2NA-R08	1	L1	.540	.7	.14	5	11	15	21	26	36	55	70	70	70	/23-0040	/04-010	R B S
GK2NB-R08	1	L1	.540	.7	.14	5	11	15	21	26	36	55	70	70	70	/23-0039	/04-028	R B S
GK2NA-S08	1	L2	.540	.7	.14	5	11	15	21	26	36	55	70	70	70	/23-0038	/04-011	R B S
GK2NB-S08	1	L2	.540	.7	.14	5	11	15	21	26	36	55	70	70	70	/23-0037	/04-029	R B S
GK2NA-R10	3	L1	.540	.7	.05	5	10	14	20	24	31	45	70	70	70	/23-0052	/04-013	R B S
GK2NB-R10	3	L1	.540	.7	.05	5	10	14	20	24	31	45	70	70	70	/23-0051	/04-031	R B S
GK2NA-S10	3	L2	.540	.7	.05	5	10	14	20	24	31	45	70	70	70	/23-0050	/04-014	R B S
GK2NB-S10	3	L2	.540	.7	.05	5	10	14	20	24	31	45	70	70	70	/23-0049	/04-032	R B S
GK2NA-R11	5	L1	.540	.7	.015	—	—	—	14	17	24	36	60	70	70	—	/04-016	R B S
GK2NB-R11	5	L1	.540	.7	.015	—	—	—	14	17	24	36	60	70	70	—	/04-034	R B S
GK2NA-S11	5	L2	.540	.7	.015	—	—	—	14	17	24	36	60	70	70	—	/04-017	R B S
GK2NB-S11	5	L2	.540	.7	.015	—	—	—	14	17	24	36	60	70	70	—	/04-035	R B S
GK2NA-R12	10	L1	.540	.7	.008	—	10	14	20	24	30	40	40	64	70	—	—	R B S
GK2NA-S12	10	L2	.540	.7	.008	—	10	14	20	24	30	40	40	64	70	—	—	R B S
GK3NA-P02	.1	$\pi$	.540	1.4	1.7	15	36	50	69	79	80	80	80	80	80	/23-0006	/04-003	R B S
GK3NB-P02	.1	$\pi$	.540	1.4	1.7	15	36	50	69	79	80	80	80	80	80	/23-0005	/04-021	R B S
GK3NA-P05	.3	$\pi$	.540	1.4	.77	—	29	44	62	73	80	80	80	80	80	/23-0018	/04-006	R B S
GK3NB-P05	.3	$\pi$	.540	1.4	.77	—	29	44	62	73	80	80	80	80	80	/23-0017	/04-024	R B S
GK3NA-P07	.5	$\pi$	.540	1.4	.36	—	21	37	56	67	80	80	80	80	80	/23-0030	/04-009	R B S
GK3NB-P07	.5	$\pi$	.540	1.4	.36	—	21	37	56	67	80	80	80	80	80	/23-0029	/04-027	R B S
GK3NA-P08	1	$\pi$	.540	1.4	.14	—	—	20	46	57	75	80	80	80	80	/23-0042	/04-012	R B S
GK3NB-P08	1	$\pi$	.540	1.4	.14	—	—	20	46	57	75	80	80	80	80	/23-0041	/04-030	R B S
GK3NA-P10	3	$\pi$	.540	1.4	.05	—	—	—	17	36	51	80	80	80	80	/23-0054	/04-015	R B S
GK3NB-P10	3	$\pi$	.540	1.4	.05	—	—	—	17	36	51	80	80	80	80	/23-0053	/04-033	R B S
GK3NA-P11	5	$\pi$	.540	1.4	.015	—	—	—	—	16	38	75	80	80	80	—	/04-018	R B S
GK3NB-P11	5	$\pi$	.540	1.4	.015	—	—	—	—	16	38	75	80	80	80	—	/04-036	R B S
GK3NA-P12	10	$\pi$	.540	1.4	.008	5	15	20	24	28	34	40	52	80	80	—	—	R B S
GK4NA-T08	1	T	1.020	.75	—	—	10	15	21	26	49	70	70	70	70	—	—	R B
GK4NA-T09	2	T	1.020	.75	—	—	10	13	17	20	32	55	70	70	70	—	—	R B
GK4NA-T16	4	T	1.020	.75	—	—	9	12	15	19	29	42	70	70	70	—	—	R B
GK4NA-T12	10	T	1.020	.75	—	—	9	12	15	19	28	55	70	70	70	—	—	R B

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



## SPECIFICATIONS

100 VDC,  
.45-1.4  $\mu$ F

AVX P/N	Current AMP	Full Load Insertion Loss Per MIL-STD-220, +25°C										<sup>2</sup> 15733 EQUIV.	<sup>2</sup> 28861 EQUIV.	<sup>3</sup> Rel. Codes		
		CKT	L. dim	<sup>1</sup> CAP	DCR	10 KHz	30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz				
GK2AA-S01	.06	L2	.540	1.4	12	15	44	70	70	70	70	70	—	—	R	
GK2AA-R01	.06	L1	.540	1.4	12	15	44	70	70	70	70	70	—	—	R	
GK2AA-S02	.1	L2	.540	1.4	10	12	34	62	70	70	70	70	—	—	R	
GK2AA-R02	.1	L1	.540	1.4	10	12	34	62	70	70	70	70	—	—	R	
GK2AA-S03	.15	L2	.540	1.4	4	7	24	52	64	70	70	70	—	—	R	
GK2AA-R03	.15	L1	.540	1.4	4	7	24	52	64	70	70	70	—	—	R	
GK2AA-S05	.3	L2	.540	1.4	.5	—	14	35	45	66	70	70	—	—	R	
GK2AA-R05	.3	L1	.540	1.4	.5	—	14	35	45	66	70	70	—	—	R	
GK2AA-S06	.45	L2	.540	1.4	.3	—	14	33	44	65	70	70	—	—	R	
GK2AA-R06	.45	L1	.540	1.4	.3	—	14	33	44	65	70	70	—	—	R	
GK2AA-S07	.5	L2	.540	1.4	1	—	16	41	54	70	70	70	/39-0002	—	R	
GK2AA-R07	.5	L1	.540	1.4	1	—	16	41	54	70	70	70	/39-0001	—	R	
GK2AA-S09	2	L2	.540	1.4	.063	—	15	28	35	51	70	70	/39-0006	—	R	
GK2AA-R09	2	L1	.540	1.4	.063	—	15	28	35	51	70	70	/39-0005	—	R	
GK2AA-S12	10	L2	.540	1.4	.008	—	14	28	33	44	52	70	/39-0010	—	R	
GK2AA-R12	10	L1	.540	1.4	.008	—	14	28	33	44	52	70	/34-0017	—	R	
GK3AA-P02	.1	$\pi$	.540	1.0	10	12	40	70	70	70	70	70	/34-0022	—	R B	
GK3AA-P07	.5	$\pi$	.540	1.0	1	—	18	60	70	70	70	70	—	—	R B	
GK3AA-P09	2	$\pi$	.540	1.0	.063	—	9	36	53	70	70	70	—	—	R B	
GK3AA-P12	10	$\pi$	1.020	1.0	.008	—	9	24	29	40	70	70	/34-0028	—	R B	
GK4AA-T08	1	T	1.020	.75	.5	—	10	25	49	70	70	70	—	—	R B	
GK4AA-T09	2	T	1.020	.75	.09	—	10	20	32	56	70	70	/25-0012	—	R B	
GK4AA-T16	4	T	1.020	.75	.03	—	10	19	29	42	70	70	/25-0007	—	R B	
GK4AA-T12	10	T	1.020	.75	.008	—	9	19	28	39	58	65	65	—	R B	
GK7AA-M04	.25	2T	1.020	1.0	12	15	70	70	70	70	70	70	/70-0001	—	R	
GK7AA-M07	.5	2T	1.020	1.0	3	—	47	70	70	70	80	80	80	/70-0002	—	R
GK7AA-M08	1	2T	1.020	1.0	.75	—	12	52	70	70	80	80	80	/70-0003	—	R
GK7AA-M09	2	2T	1.020	1.0	.189	—	—	33	56	70	80	80	80	/70-0004	—	R
GK7AA-M10	3	2T	1.020	1.0	.081	—	—	24	54	70	80	80	80	/70-0005	—	R
GK7AA-M12	10	2T	1.020	1.0	.008	4	12	25	32	42	70	70	70	/70-0006	—	R
GK2AA-R04	.25	L1	.540	.45	1.5	—	—	38	50	60	60	60	60	/25-0009	/02-001	R B S
GK2AB-R04	.25	L1	.540	.45	1.5	—	—	38	50	60	60	60	60	/25-0021	/02-013	R B S
GK2AA-S04	.25	L2	.540	.45	1.5	—	—	38	50	60	60	60	60	/25-0011	/02-002	R B S
GK2AB-S04	.25	L2	.540	.45	1.5	—	—	38	50	60	60	60	60	/25-0023	/02-014	R B S
GK3AA-P04	.25	$\pi$	.540	.90	1.5	—	—	64	80	80	80	80	80	/25-0010	/02-003	R B S
GK3AB-P04	.25	$\pi$	.540	.90	1.5	—	—	64	80	80	80	80	80	/25-0022	/02-015	R B S

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.

continued



## CYLINDRICAL STYLE EMI FILTERS

**GK SERIES** Hermetically Sealed  
Circuits Available - L,  $\pi$ , T, 2T .375/.410 DIA.

100 VDC,  
.45-.90  $\mu$ F

continued

## SPECIFICATIONS

Full Load Insertion Loss Per MIL-STD-220, + 25°C

AVX P/N	Current AMP	CKT	L. dim	'CAP	DCR	10 KHz	30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz	<sup>2</sup> 15733 EQUIV.	<sup>2</sup> 28861 EQUIV.	<sup>3</sup> Rel. Codes
GK2AA-R08	1.0	L1	.540	.45	.25	—	—	23	34	55	60	60	60	—	/02-004	R B S
GK2AB-R08	1.0	L1	.540	.45	.25	—	—	23	34	55	60	60	60	—	/02-016	R B S
GK2AA-S08	1.0	L2	.540	.45	.25	—	—	23	34	55	60	60	60	—	/02-005	R B S
GK2AB-S08	1.0	L2	.540	.45	.25	—	—	23	34	55	60	60	60	—	/02-017	R B S
GK3AA-P08	1.0	$\pi$	.540	.90	.25	—	—	52	70	80	80	80	80	—	/02-006	R B S
GK3AB-P08	1.0	$\pi$	.540	.90	.25	—	—	52	70	80	80	80	80	—	/02-018	R B S
GK2AA-R10	3.0	L1	.540	.45	.05	—	—	18	27	45	60	60	60	—	/02-007	R B S
GK2AB-R10	3.0	L1	.540	.45	.05	—	—	18	27	45	60	60	60	—	/02-019	R B S
GK2AA-S10	3.0	L2	.540	.45	.05	—	—	18	27	45	60	60	60	—	/02-008	R B S
GK2AB-S10	3.0	L2	.540	.45	.05	—	—	18	27	45	60	60	60	—	/02-020	R B S
GK3AA-P10	3.0	$\pi$	.540	.90	.05	—	—	25	51	80	80	80	80	/25-0004	/02-009	R B S
GK3AB-P10	3.0	$\pi$	.540	.90	.05	—	—	25	51	80	80	80	80	/25-0016	/02-021	R B S
GK2AA-R11	5.0	L1	.540	.45	.015	—	—	17	24	36	60	60	60	/25-0005	/02-010	R B S
GK2AB-R11	5.0	L1	.540	.45	.015	—	—	17	24	36	60	60	60	/25-0017	/02-022	R B S
GK2AA-S11	5.0	L2	.540	.45	.015	—	—	17	24	36	60	60	60	/25-0008	/02-011	R B S
GK2AB-S11	5.0	L2	.540	.45	.015	—	—	17	24	36	60	60	60	/25-0020	/02-023	R B S
GK3AA-P11	5.0	$\pi$	.540	.90	.015	—	—	—	38	75	80	80	80	/39-0018	/02-012	R B S
GK3AB-P11	5.0	$\pi$	.540	.90	.015	—	—	—	38	75	80	80	80	—	/02-024	R B S

<sup>1</sup>Decimal point values indicate capacitance in microfarads.

Non decimal point values indicate capacitance in picofarads.

<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



## CYLINDRICAL STYLE EMI FILTERS

## GK SERIES

Hermetically Sealed  
Circuits Available - L,  $\pi$ , T

.375/.410 DIA.

## SPECIFICATIONS

150 VDC,  
.25-.50  $\mu$ F

AVX P/N	Current AMP	CKT	L. dim	1'CAP	DCR	Full Load Insertion Loss Per MIL-STD-220, +25°C							15733 EQUIV.	28861 EQUIV.	3 Rel. Codes
						100 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
GK2HA-R02	.1	L1	.540	.25	1.7	32	39	51	60	60	60	70	/23-0010	/03-001	R B S
GKHB-R02	.1	L1	.540	.25	1.7	32	39	51	60	60	60	70	/23-0009	/03-019	R B S
GK2HA-S02	.1	L2	.540	.25	1.7	32	39	51	60	60	60	70	/23-0008	/03-002	R B S
GK2HB-S02	.1	L2	.540	.25	1.7	32	39	51	60	60	60	70	/23-0007	/03-020	R B S
GK2HA-R05	.3	L1	.540	.25	.77	25	30	44	60	60	60	70	/23-0022	/03-004	R B S
GK2HB-R05	.3	L1	.540	.25	.77	25	30	44	60	60	60	70	/23-0021	/03-022	R B S
GK2HA-S05	.3	L2	.540	.25	.77	25	30	44	60	60	60	70	/23-0020	/03-005	R B S
GK2HB-S05	.3	L2	.540	.25	.77	25	30	44	60	60	60	70	/23-0019	/03-023	R B S
GK2HA-R07	.5	L1	.540	.25	.36	20	26	39	59	60	60	70	/23-0034	/03-007	R B S
GK2HB-R07	.5	L1	.540	.25	.36	20	26	39	59	60	60	70	/23-0033	/03-025	R B S
GK2HA-S07	.5	L2	.540	.25	.36	20	26	39	59	60	60	70	/23-0032	/03-008	R B S
GK2HB-S07	.5	L2	.540	.25	.36	20	26	39	59	60	60	70	/23-0031	/03-026	R B S
GK2HA-R08	1.0	L1	.540	.25	.14	12	16	26	48	60	60	70	/23-0046	/03-010	R B S
GK2HB-R08	1.0	L1	.540	.25	.14	12	16	26	48	60	60	70	/23-0045	/03-028	R B S
GK2HA-S08	1.0	L2	.540	.25	.14	12	16	26	48	60	60	70	/23-0044	/03-011	R B S
GK2HB-S08	1.0	L2	.540	.25	.14	12	16	26	48	60	60	70	/23-0043	/03-029	R B S
GK2HA-R10	3.0	L1	.540	.25	.05	11	15	20	36	60	60	70	/23-0058	/03-013	R B S
GK2HB-R10	3.0	L1	.540	.25	.05	11	15	20	36	60	60	70	/23-0057	/03-031	R B S
GK2HA-S10	3.0	L2	.540	.25	.05	11	15	20	36	60	60	70	/23-0056	/03-014	R B S
GK2HB-S10	3.0	L2	.540	.25	.05	11	15	20	36	60	60	70	/23-0055	/03-032	R B S
GK2HA-R11	5.0	L1	.540	.25	.015	8	12	20	32	60	60	70	—	/03-016	R B S
GK2HB-R11	5.0	L1	.540	.25	.015	8	12	20	32	60	60	70	—	/03-034	R B S
GK2HA-S11	5.0	L2	.540	.25	.015	8	12	20	32	60	60	70	—	/03-017	R B S
GK2HB-S11	5.0	L2	.540	.25	.015	8	12	20	32	60	60	70	—	/03-035	R B S
GK2HA-R12	10.0	L1	.540	.25	.008	15	19	25	36	40	60	70	—	—	R B S
GK2HA-S12	10.0	L2	.540	.25	.008	15	19	25	36	40	60	70	—	—	R B S
GK3HA-P02	0.1	$\pi$	.540	.50	1.7	49	60	70	80	80	80	80	/23-0012	/03-003	R B S
GK3HB-P02	0.1	$\pi$	.540	.50	1.7	49	60	70	80	80	80	80	/23-0011	/03-021	R B S
GK3HA-P05	0.3	$\pi$	.540	.50	.77	43	53	70	80	80	80	80	/23-0024	/03-006	R B S
GK3HB-P05	0.3	$\pi$	.540	.50	.77	43	53	70	80	80	80	80	/23-0023	/03-024	R B S
GK3HA-P07	0.5	$\pi$	.540	.50	.36	37	48	66	80	80	80	80	/23-0036	/03-009	R B S
GK3HB-P07	0.5	$\pi$	.540	.50	.36	37	48	66	80	80	80	80	/23-0035	/03-027	R B S
GK3HA-P08	1.0	$\pi$	.540	.50	.14	28	40	58	80	80	80	80	/23-0048	/03-012	R B S
GK3HB-P08	1.0	$\pi$	.540	.50	.14	28	40	58	80	80	80	80	/23-0047	/03-030	R B S
GK3HA-P10	3.0	$\pi$	.540	.50	.05	—	—	38	70	80	80	80	/23-0060	/03-015	R B S
GK3HB-P10	3.0	$\pi$	.540	.50	.05	—	—	38	70	80	80	80	/23-0059	/03-033	R B S
GK3HA-P11	5.0	$\pi$	.540	.50	.015	—	—	20	63	80	80	80	—	/03-018	R B S
GK3HB-P11	5.0	$\pi$	.540	.50	.015	—	—	20	63	80	80	80	—	/03-036	R B S
GK3HA-P12	10.0	$\pi$	.540	.50	.008	—	—	—	15	60	80	80	—	—	R B
GK4HA-T08	1	T	1.020	.25	.5	15	23	42	70	80	80	80	—	—	R B
GK4HA-T09	2	T	1.020	.25	.09	9	13	32	50	70	80	80	—	—	R B
GK4HA-T16	4	T	1.020	.25	.03	6	10	21	40	60	80	80	—	—	R B
GK4HA-T12	10	T	1.020	.25	.006	—	9	21	28	44	60	80	—	—	R B

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



## CYLINDRICAL STYLE EMI FILTERS

## GK SERIES Hermetically Sealed

Circuits Available -L, T, T

.375/.410 DIA.

## SPECIFICATIONS

200 VDC,  
.15-.36 $\mu$ F

AVX P/N	Current AMP	CKT	L. dim	1 <sup>1</sup> CAP	DCR	Full Load Insertion Loss Per MIL-STD-220, + 25°C									215733 EQUIV.	28861 EQUIV.	3Rel. Codes
						10 KHz	30, KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz				
GK2BA-S02	.1	L2	.540	.36	10	—	21	50	61	70	70	70	70	/23-0008	—	R	
GK2BA-R02	.1	L1	.540	.36	10	—	21	50	61	70	70	70	70	/23-0010	—	R	
GK2BA-S04	.25	L2	.540	.36	.4	—	11	39	51	70	70	70	70	—	—	R	
GK2BA-R04	.25	L1	.540	.36	4	—	11	39	51	70	70	70	70	—	—	R	
GK2BA-S07	.5	L2	.540	.36	1	—	3	29	41	63	70	70	70	/23-0032	—	R	
GK2BA-R07	.5	L1	.540	.36	1	—	3	29	41	63	70	70	70	/23-0034	—	R	
GK2BA-S08	1	L2	.540	.36	.25	—	—	18	28	49	70	70	70	/23-0044	—	R	
GK2BA-R08	1	L1	.540	.36	.25	—	—	18	28	49	70	70	70	/23-0046	—	R	
GK2BA-S09	2	L2	.540	.36	.063	—	—	15	21	38	70	70	70	/23-0056	—	R	
GK2BA-R09	2	L1	.540	.36	.063	—	—	15	21	38	70	70	70	/23-0058	—	R	
GK2BA-S10	3	L2	.540	.36	.027	—	—	15	21	31	70	70	70	—	—	R	
GK2BA-R10	3	L1	.540	.36	.027	—	—	15	21	31	70	70	70	—	—	R	
GK2BA-S12	10	L2	.540	.36	.008	—	—	15	21	31	51	60	60	—	—	R	
GK2BA-R12	10	L1	.540	.36	.008	—	—	15	21	31	51	60	60	—	—	R	
GK3BA-P02	.1	$\pi$	.540	.36	10	—	21	61	70	70	70	70	70	/23-0012	—	RB	
GK3BA-P04	.25	$\pi$	.540	.36	4	—	10	52	68	70	70	70	70	—	—	RB	
GK3BA-P07	.5	$\pi$	.540	.36	1	—	—	44	63	70	70	70	70	/23-0036	—	RB	
GK3BA-P08	1	$\pi$	.540	.36	.25	—	—	30	46	70	70	70	70	/23-0048	—	RB	
GK3BA-P09	2	$\pi$	.540	.36	.063	—	—	16	33	63	70	70	70	—	—	RB	
GK3BA-P10	3	$\pi$	.540	.36	.027	—	—	—	21	55	70	70	70	—	—	RB	
GK3BA-P12	10	$\pi$	.540	.36	.008	—	—	—	20	30	70	70	70	—	—	RB	
GK4BA-T08	1	T	1.020	.36	.5	—	3	17	42	70	70	70	70	—	—	R	
GK4BA-T09	2	T	1.020	.36	.09	—	—	12	24	48	70	70	70	—	—	R	
GK4BA-T16	4	T	1.020	.36	.03	—	—	12	21	34	70	70	70	—	—	R	
GK4BA-T12	10	T	1.020	.36	.008	—	3	12	21	31	50	60	60	—	—	R	
200 VDC-125 VAC/400 Hz .15-.30 $\mu$ F																	
GK2LA-S02	.1	L2	.540	.15	10	—	14	42	54	70	70	70	70	—	—	R B	
GK2LA-R02	.1	L1	.540	.15	10	—	14	42	54	70	70	70	70	—	—	RB	
GK2LA-S07	.5	L2	.540	.15	1	—	—	23	35	56	70	70	70	—	—	RB	
GK2LA-R07	.5	L1	.540	.15	1	—	—	23	35	56	70	70	70	—	—	RB	
GK2LA-S09	2	L2	.540	.15	.063	—	—	8	14	30	70	70	70	—	—	RB	
GK2LA-R09	2	L1	.540	.15	.063	—	—	8	14	30	70	70	70	—	—	RB	
GK2LA-S12	10	L2	.540	.15	.008	—	—	8	14	25	45	60	60	—	—	RB	
GK2LA-R12	10	L1	.540	.15	.008	—	—	8	14	25	45	60	60	—	—	RB	
GK3LA-P02	.1	$\pi$	.540	.3	10	—	21	60	70	70	70	70	70	—	—	RB	
GK3LA-P07	.5	$\pi$	.540	.3	1	—	—	40	56	70	70	70	70	—	—	RB	
GK3LA-P10	3	$\pi$	.540	.3	.027	—	—	—	25	54	70	70	70	—	—	RB	
GK3LA-P12	10	$\pi$	.540	.3	.008	—	—	—	20	30	70	70	70	—	—	RB	

<sup>1</sup>Decimal point values indicate capacitance in microfarads.

Non decimal point values indicate capacitance in picofarads.

<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.

continued



## SPECIFICATIONS

200 VDC/125 VAC/400 Hz,  
.15-.30  $\mu$ F

continued

AVX P/N	Current AMP	CKT	L dim	'CAP	DCR	Full Load Insertion Loss Per MIL-STD-220, +25°C								^15733 EQUIV.	^28861 EQUIV.	^3Rel. Codes
						10 KHz	30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
GK2LA-R04	.25	L1	.540	.15	1.5	—	6	28	40	60	60	60	70	—	/05-001	R B S
GK2LB-R04	.25	L1	.540	.15	1.5	—	6	28	40	60	60	60	70	—	/05-013	R B S
GK2LA-S04	.25	L2	.540	.15	1.5	—	6	28	40	60	60	60	70	—	/05-002	R B S
GK2LB-S04	.25	L2	.540	.15	1.5	—	6	28	40	60	60	60	70	—	/05-014	R B S
GK2LA-R08	1	L1	.540	.15	.25	—	—	13	24	45	60	60	70	/26-0001	/05-004	R B S
GK2LB-R08	1	L1	.540	.15	.25	—	—	13	24	45	60	60	70	/26-0013	/05-016	R B S
GK2LA-S08	1	L2	.540	.15	.25	—	—	13	24	45	60	60	70	/26-0003	/05-005	R B S
GK2LB-S08	1	L2	.540	.15	.25	—	—	13	24	45	60	60	70	/26-0015	/05-017	R B S
GK2LA-R10	3	L1	.540	.15	.05	—	—	8	16	30	60	60	70	/26-0004	/05-007	R B S
GK2LB-R10	3	L2	.540	.15	.05	—	—	8	16	30	60	60	70	/26-0016	/05-019	R B S
GK2LA-S10	3	L1	.540	.15	.05	—	—	8	16	30	60	60	70	/26-0006	/05-008	R B S
GK2LB-S10	3	L2	.540	.15	.05	—	—	8	16	30	60	60	70	/26-0018	/05-020	R B S
GK2LA-R11	5	L1	.540	.15	.015	—	—	8	14	26	55	55	70	/26-0007	/05-010	R B S
GK2LB-R11	5	L1	.540	.15	.015	—	—	8	14	26	55	55	70	/26-0019	/05-022	R B S
GK2LA-S11	5	L2	.540	.15	.015	—	—	8	14	26	55	55	70	/26-0010	/05-011	R B S
GK2LB-S11	5	L2	.540	.15	.015	—	—	8	14	26	55	55	70	/26-0022	/05-023	R B S
GK3LA-P04	.25	$\pi$	.540	.30	1.5	—	8	44	62	80	80	80	80	/26-0011	/05-003	R B S
GK3LB-P04	.25	$\pi$	.540	.30	1.5	—	8	44	62	80	80	80	80	/26-0023	/05-015	R B S
GK3LA-P08	1	$\pi$	.540	.30	.25	—	—	32	50	80	80	80	80	/26-0002	/05-006	R B S
GK3LB-P08	1	$\pi$	.540	.30	.25	—	—	32	50	80	80	80	80	/26-0014	/05-018	R B S
GK3LA-P10	3	$\pi$	.540	.30	.05	—	—	—	19	59	80	80	80	/26-0005	/05-009	R B S
GK3LB-P10	3	$\pi$	.540	.30	.05	—	—	—	19	59	80	80	80	/26-0017	/05-021	R B S
GK3LA-P11	5	$\pi$	.540	.30	.015	—	—	—	—	51	80	80	80	/26-0009	/05-012	R B S
GK3LB-P11	5	$\pi$	.540	.30	.015	—	—	—	—	51	80	80	80	/26-0021	/05-024	R B S
GK4LA-T08	1	T	1.020	.15	.5	—	—	10	36	66	70	70	70	—	—	R
GK4LA-T09	2	T	1.020	.15	.09	—	—	7	18	41	70	70	70	/26-0012	—	R
GK4LA-T16	4	T	1.020	.15	.03	—	—	8	15	27	70	70	70	/59-0008	—	R
GK4LA-T12	10	T	1.020	.15	.008	—	—	8	15	25	70	70	70	—	—	R
GK7LA-M04	.25	2T	1.020	.3	.12	—	53	70	70	70	80	80	80	—	—	R
GK7LA-M07	.5	2T	1.020	.3	.3	—	17	66	70	70	80	80	80	—	—	R
GK7LA-M08	1	2T	1.020	.3	.75	—	—	32	59	70	80	80	80	—	—	R
GK7LA-M09	2	2T	1.020	.3	.189	—	—	6	34	70	70	70	70	—	—	R
GK7LA-M10	3	2T	1.020	.3	.081	—	—	3	22	70	70	70	70	—	—	R
GK7LA-M12	10	2T	1.020	.3	.008	—	5	14	21	34	55	70	70	—	—	R

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



## APPLICATIONS

The JD series offers effective filtering from 14 KHz to 10 GHz. The large diameter, increased length, restricted capacitance values and conservative dielectrics of the JD series are particularly important design features for 400 Hz AC applications where high reactive currents and the resultant heat dissipation must be controlled. Glass sealed on both ends for hermeticity, this series is impervious to high moisture, solvents, or other severe environmental conditions commonly encountered in military applications. It is designed for bulkhead mounting in a slotted hole with nut and lockwasher supplied.

The 230 VAC "T" section style is uniquely capable of handling very high pulse inrush currents or overvoltage conditions typical of EMP.

In addition, transient voltage suppression devices can be added to any of the JD circuit designs to provide complete circuit protection against EMP, lightning, or voltage spikes such as MIL-STD-704. These devices when combined with high frequency attenuation characteristics of the discoidal capacitor and toroidal inductors offer significant performance

6  
16

## SPECIFICATIONS

1. Case/Terminal Plating: Electro-tin standard - Silver or gold available

2. Material:

Case: Brass standard - Steel available

End seal: Mild steel

Terminals: Nickel-iron alloy

3. Operating Temperature Range:  
- 55°C to + 125°C

4. Electrical Characteristics:

A. Rated Voltage:

300 VDC/125 VAC, 400 Hz or  
400 VDC/230 VAC, 400 Hz

B. Current Rating - see chart

advantages by suppressing and absorbing the EMI pulse over a very broad spectral range. Very high pulse currents will occur within the EMI filter, however, re-radiation to sensitive electronic circuits is prevented by the fully-shielded case design. In some cases a slight increase in the case length of the filter is required to provide space for the transient suppression device.

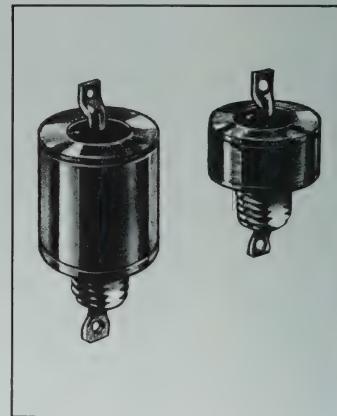
The "L", and the "T" designs are designed to provide effective attenuation over a wide range of circuit impedances. For current ratings under 15 Amps toroidal wound inductor elements offer increased filter performance and protection against circuit transients. Data showing the actual inductance versus various levels of DC or AC bias current are available as well as the attenuation in any combination of source and load impedance.

Alternate lead configurations or special capacitance/inductance values may be ordered.

Custom packages or filter arrays utilizing the JD series can be furnished.

## CHARACTERISTICS

- Designed to meet the requirements of DESC drawings 84083, 84084 and MIL-F-28861/16 and /17.
- Glass hermetic seal on both ends.
- Wound toroidal inductor used in designs up to 10 Amps. 15 Amp designs incorporate ferrite bead inductor.
- Superior heat dissipation for both 125 VAC and 230 VAC designs.



C. Insulation Resistance:

At 25°C: 1,000 megohm-microfarad min., or 50,000 megohms, min., whichever is less, at rated DC voltage

At 125°C: 100 megohm-microfarad min., or 5,000 megohms min., whichever is less

D. Dielectric Withstanding Voltage (DWV):

R-level designs:

2.0 times rated DC voltage

Class B, Class S designs:

2.5 times rated DC voltage

E. Capacitance: total capacitance listed in chart for each filter type is "guaranteed minimum value" (GMV)

5. Marking:

Standard Marking: AVX, AVX part number, rated voltage, current, lot number, schematic

NOTE: Schematic to indicate location of inductor (standard or reverse) for JD2 L section filters

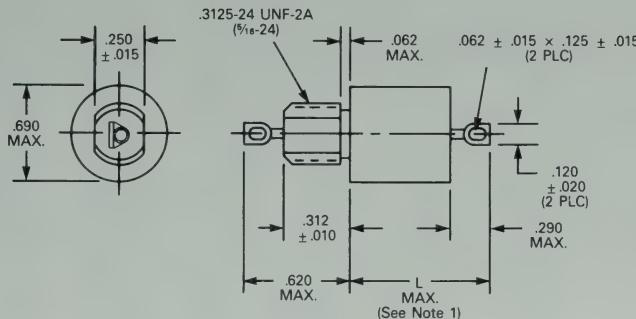
See Reliability Codes section for definition of Reliability Level marking. See How to Order section for part number construction.

6. Installation:

A. Mounting Torque:

60 oz-in.  $\pm$  4 oz-in.

B. Refer to "Installation and Handling" section of Filter Design Guide.

**CYLINDRICAL STYLE EMI FILTERS****JD SERIES****Hermetically Sealed  
Circuits Available - C, L,  $\pi$ , T****.690 DIA.****STANDARD CONFIGURATION****METRIC EQUIVALENTS**

IN	MM	IN	MM
.003	.08	.250	6.35
.005	.13	.290	7.37
.007	.18	.312	7.92
.010	.25	.375	9.53
.015	.38	.420	10.67
.020	.51	.440	11.18
.022	.56	.620	15.75
.045	1.14	.680	17.27
.062	1.57	.700	17.78
.093	2.36	1.060	26.92
.120	3.05	1.205	30.61
.125	3.18	1.300	33.02

(See Note 2)

**MIL-F-28861/17  
(See P/N Table)**

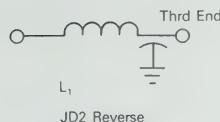
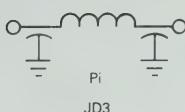
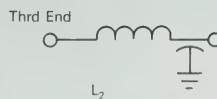
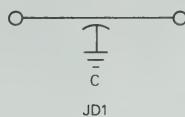
Dash No.	L Dimension Max.	Weight (grams) Max.
001	.700	18.0
002	1.060	20.0
003	1.060	20.0
004	1.060	20.0
005	1.060	20.0
006	1.060	20.0
007	1.060	20.0
008	1.060	20.0
009	1.060	20.0
010	1.060	20.0
011	1.060	20.0
012	1.205	29.0
013	1.205	29.0
014	1.205	29.0
015	1.205	29.0
016	1.205	29.0
017	1.300	29.0
018	1.300	29.0
019	1.300	29.0

**MIL-F-28861/16  
(See P/N Table)**

Dash No.	L Dimension Max.
001	.700
002 through 011	1.060
012 through 016	1.205
017 through 019	1.300

**NOTES:**

1. Refer to Part Number Table for L-Max for specific filter.
2. Metric equivalent dimensions given for information only.
3. All dimensions for JD series filters established per MIL-F-28861/16 and /17, and DESC 84083 and 8404 requirements.

**CIRCUIT DIAGRAMS**



## CYLINDRICAL STYLE EMI FILTERS

## JD SERIES

Hermetically Sealed  
Circuits Available - C, L,  $\pi$ , T

.690 DIA.

## SPECIFICATIONS

300 VDC/125 VAC/400 Hz\*  
400 VDC/230 VAC/400 Hz\*  
.15-.36 $\mu$ F

AVX P/N	Current AMP	Ckt	DC Voltage*	Full Load Insertion Loss Per MIL-STD-220, +25°C												
				DCR	L. dim	50 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz	<sup>2</sup> 15733 EQUIV.	<sup>2</sup> 28861 EQUIV.	<sup>3</sup> Rel. Codes	
JD1LB-304	15	C	.3	300	.008	.700	7	16	22	32	46	58	70	—	/17-001	R B
JD2LB-S07	.5	L2	.3	300	.33	1.060	13	28	40	60	60	70	70	—	/17-003	R B
JD2LB-R07	.5	L1	.3	300	.33	1.060	13	28	40	60	60	70	70	—	/17-002	R B
JD2LB-S08	1	L2	.3	300	.15	1.060	6	24	37	56	60	70	70	—	/17-005	R B
JD2LB-R08	1	L1	.3	300	.15	1.060	6	24	37	56	60	70	70	—	/17-004	R B
JD2LB-S10	3	L2	.3	300	.026	1.060	7	17	24	42	70	70	70	—	/17-007	R B
JD2LB-R10	3	L1	.3	300	.026	1.060	7	17	24	42	70	70	70	—	/17-006	R B
JD2LB-S11	5	L2	.3	300	.013	1.060	7	16	22	34	68	70	70	—	/17-009	R B
JD2LB-R11	5	L1	.3	300	.013	1.060	7	16	22	34	68	70	70	—	/17-008	R B
JD2LB-S12	10	L2	.3	300	.008	1.060	7	16	20	30	56	70	70	—	/17-011	R B
JD2LB-R12	10	L1	.3	300	.008	1.060	7	16	20	30	56	70	70	/34-0012	/17-010	R B
JD3LB-P07	.5	$\pi$	.36	300	.33	1.205	14	44	62	80	80	80	80	—	/17-012	R B
JD3LB-P08	1	$\pi$	.36	300	.15	1.205	—	37	56	80	80	80	80	—	/17-013	R B
JD3LB-P10	3	$\pi$	.36	300	.026	1.205	—	18	40	70	80	80	80	—	/17-014	R B
JD3LB-P11	5	$\pi$	.36	300	.013	1.205	—	—	25	60	80	80	80	—	/17-015	R B
JD3LB-P12	10	$\pi$	.36	300	.008	1.205	—	—	—	50	80	80	80	—	/17-016	R B
JD4LB-T08	1	T	.3	300	.07	1.400	6	18	28	58	70	70	70	—	/17-017	R B
JD4LB-T09	2	T	.3	300	.05	1.400	6	16	22	37	70	70	70	—	/17-018	R B
JD4LB-T16	4	T	.3	300	.03	1.400	6	16	20	34	70	70	70	—	/17-019	R B
JD4LB-T12	10	T	.3	300	.008	1.400	—	—	19	30	48	50	70	—	—	R B
JD1EB-154	15	C	.15	400	.008	.700	—	10	16	26	40	52	70	—	/16-001	R B
JD2EB-S07	.5	L2	.15	400	.33	1.060	5	24	32	50	60	70	70	—	/16-003	R B
JD2EB-R07	.5	L1	.15	400	.33	1.060	5	24	32	50	60	70	70	—	/16-002	R B
JD2EB-S08	1	L2	.15	400	.15	1.060	—	19	30	46	60	70	70	—	/16-005	R B
JD2EB-R08	1	L1	.15	400	.15	1.060	—	19	30	46	60	70	70	—	/16-004	R B
JD2EB-S10	3	L2	.15	400	.026	1.060	—	11	19	36	60	70	70	—	/16-007	R B
JD2EB-R10	3	L1	.15	400	.026	1.060	—	11	19	36	60	70	70	—	/16-006	R B
JD2EB-S11	5	L2	.15	400	.013	1.060	—	10	16	28	54	70	70	—	/16-009	R B
JD2EB-R11	5	L1	.15	400	.013	1.060	—	10	16	28	54	70	70	—	/16-008	R B
JD2EB-S12	10	L2	.15	400	.008	1.060	—	10	16	25	48	70	70	—	/16-011	R B
JD2EB-R12	10	L1	.15	400	.008	1.060	—	10	16	25	48	70	70	—	/16-010	R B
JD3EB-P07	.5	$\pi$	.2	400	.33	1.205	—	34	52	80	80	80	80	—	/16-012	R B
JD3EB-P08	1	$\pi$	.2	400	.15	1.205	—	27	46	74	80	80	80	—	/16-013	R B
JD3EB-P10	3	$\pi$	.2	400	.026	1.205	—	—	30	60	80	80	80	—	/16-014	R B
JD3EB-P11	5	$\pi$	.2	400	.013	1.205	—	—	12	50	80	80	80	—	/16-015	R B
JD3EB-P12	10	$\pi$	.2	400	.008	1.205	—	—	—	30	80	80	80	—	/16-016	R B
JD4EB-T08	1	T	.15	400	.07	1.300	—	12	25	48	70	70	70	—	/16-017	R B
JD4EB-T09	2	T	.15	400	.05	1.300	—	10	18	40	64	70	70	—	/16-018	R B
JD4EB-T16	4	T	.15	400	.03	1.300	—	10	16	31	58	70	70	—	/16-019	R B
JD4EB-T12	10	T	.15	400	.008	1.300	—	—	15	25	45	60	70	—	—	R B

\*NOTE: All 300 VDC also rated 125 VAC/400 Hz. All 400 VDC also rated 230 VAC/400 Hz.

\*Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.

\*Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.

\*See Filter Design Guide, Reliability Levels.



## SPECIFICATIONS

100-200 VDC  
.45-.2.8  $\mu$ F

AVX P/N	Current AMP	CKT	CAP	DC Voltage	DCR	L dim	Full Load Insertion Loss Per MIL-STD-220, +25°C								<sup>2</sup> 15733 EQUIV.	<sup>3</sup> Rel. Codes
							50 KHz	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz			
JD1AB-125	15	C	1.2	100	.008	.700	16	27	34	43	60	60	60	—	—	R B
JD1AB-704	15	C	1.2	100	.008	.700	10	19	28	40	50	60	60	—	—	R B
JD2AB-S07	.5	L2	1.4	100	.3	1.060	21	40	58	70	70	70	70	—	—	R B
JD2AB-R07	.5	L1	1.4	100	.3	1.060	21	40	58	70	70	70	70	—	—	R B
JD2AB-S08	1	L2	1.4	100	.21	1.060	19	37	55	70	70	70	70	—	—	R B
JD2AB-R08	1	L1	1.4	100	.21	1.060	19	37	55	70	70	70	70	—	—	R B
JD2AB-S10	3	L2	1.4	100	.03	1.060	16	26	37	55	70	70	70	—	—	R B
JD2AB-R10	3	L1	1.4	100	.03	1.060	16	26	37	55	70	70	70	—	—	R B
JD2AB-S11	5	L2	1.4	100	.007	1.060	15	25	34	46	70	70	70	—	—	R B
JD2AB-R11	5	L1	1.4	100	.007	1.060	15	25	34	46	70	70	70	—	—	R B
JD2AB-S12	10	L2	1.4	100	.006	1.060	15	24	34	44	70	70	70	—	—	R B
JD2AB-R12	10	L1	1.4	100	.006	1.060	15	24	34	44	70	70	70	—	—	R B
JD3AB-P07	.5	$\pi$	2.8	100	.3	1.205	40	70	80	80	80	80	80	—	—	R B
JD3AB-P08	1	$\pi$	2.8	100	.21	1.205	35	68	80	80	80	80	80	—	—	R B
JD3AB-P10	3	$\pi$	2.8	100	.03	1.205	13	43	73	80	80	80	80	—	—	R B
JD3AB-P11	5	$\pi$	2.8	100	.007	1.205	—	26	63	80	80	80	80	/34-0009	—	R B
JD3AB-P12	10	$\pi$	2.8	100	.006	1.205	20	30	40	70	70	80	80	—	—	R B
JD4AB-T08	1	T	1.4	100	.5	1.400	21	48	70	70	70	70	70	—	—	R B
JD4AB-T09	2	T	1.4	100	.09	1.400	15	26	44	70	70	70	70	—	—	R B
JD4AB-T16	4	T	1.4	180	.03	1.400	15	24	35	50	70	70	70	—	—	R B
JD4AB-T12	10	T	1.4	100	.005	1.400	14	24	34	44	60	70	70	—	—	R B
JD1BB-904	15	C	.9	200	.006	.700	12	21	30	40	53	60	60	—	—	R B
JD1BB-454	15	C	.45	200	.006	.700	6	16	24	34	51	60	60	—	—	R B
JD2BB-S07	.5	L2	.45	200	.3	1.060	10	30	48	65	70	70	70	—	—	R B
JD2BB-R07	.5	L1	.45	200	.3	1.060	10	30	48	65	70	70	70	—	—	R B
JD2BB-S08	1	L2	.45	200	.21	1.060	8	28	45	65	70	70	70	—	—	R B
JD2BB-R08	1	L1	.45	200	.21	1.060	8	28	45	65	70	70	70	—	—	R B
JD2BB-S10	3	L2	.45	200	.03	1.060	6	16	28	45	60	70	70	—	—	R B
JD2BB-R10	3	L1	.45	200	.03	1.060	6	16	28	45	60	70	70	—	—	R B
JD2BB-S11	5	L2	.45	200	.007	1.060	6	14	24	36	52	70	70	70	/34-0021	R B
JD2BB-R11	5	L1	.45	200	.007	1.060	6	14	24	36	52	70	70	70	—	R B
JD2BB-S12	10	L2	.45	200	.006	1.060	6	15	24	34	50	70	70	—	—	R B
JD2BB-R12	10	L1	.45	200	.006	1.060	6	15	24	34	50	70	70	—	—	R B
JD3BB-P07	.5	$\pi$	.9	200	.3	1.205	15	50	70	80	80	80	80	—	—	R B
JD3BB-P08	1	$\pi$	.9	200	.21	1.205	11	46	70	80	80	80	80	—	—	R B
JD3BB-P10	3	$\pi$	.9	200	.03	1.205	—	18	50	80	80	80	80	—	—	R B
JD3BB-P11	5	$\pi$	.9	200	.007	1.205	—	13	40	70	80	80	80	—	—	R B
JD3BB-P12	10	$\pi$	.9	200	.006	1.205	9	20	30	40	55	80	80	—	—	R B
JD4BB-T08	1	T	.45	200	.3	1.400	18	50	70	80	80	80	80	—	—	R B
JD4BB-T09	2	T	.45	200	.21	1.400	12	48	70	80	80	80	80	—	—	R B
JD4BB-T16	4	T	.45	200	.03	1.400	—	18	52	80	80	80	80	—	—	R B
JD4BB-T12	10	T	.45	200	.006	1.400	—	12	40	70	80	80	80	—	—	R B

<sup>1</sup>Decimal point values indicate capacitance in microfarads. Non decimal point values indicate capacitance in picofarads.<sup>2</sup>Equivalent QPL part numbers for reference only. See Military Specifications section of catalog for specific AVX Filters QPL approvals.<sup>3</sup>See Filter Design Guide, Reliability Levels.



# MILITARY QUALIFIED PRODUCTS

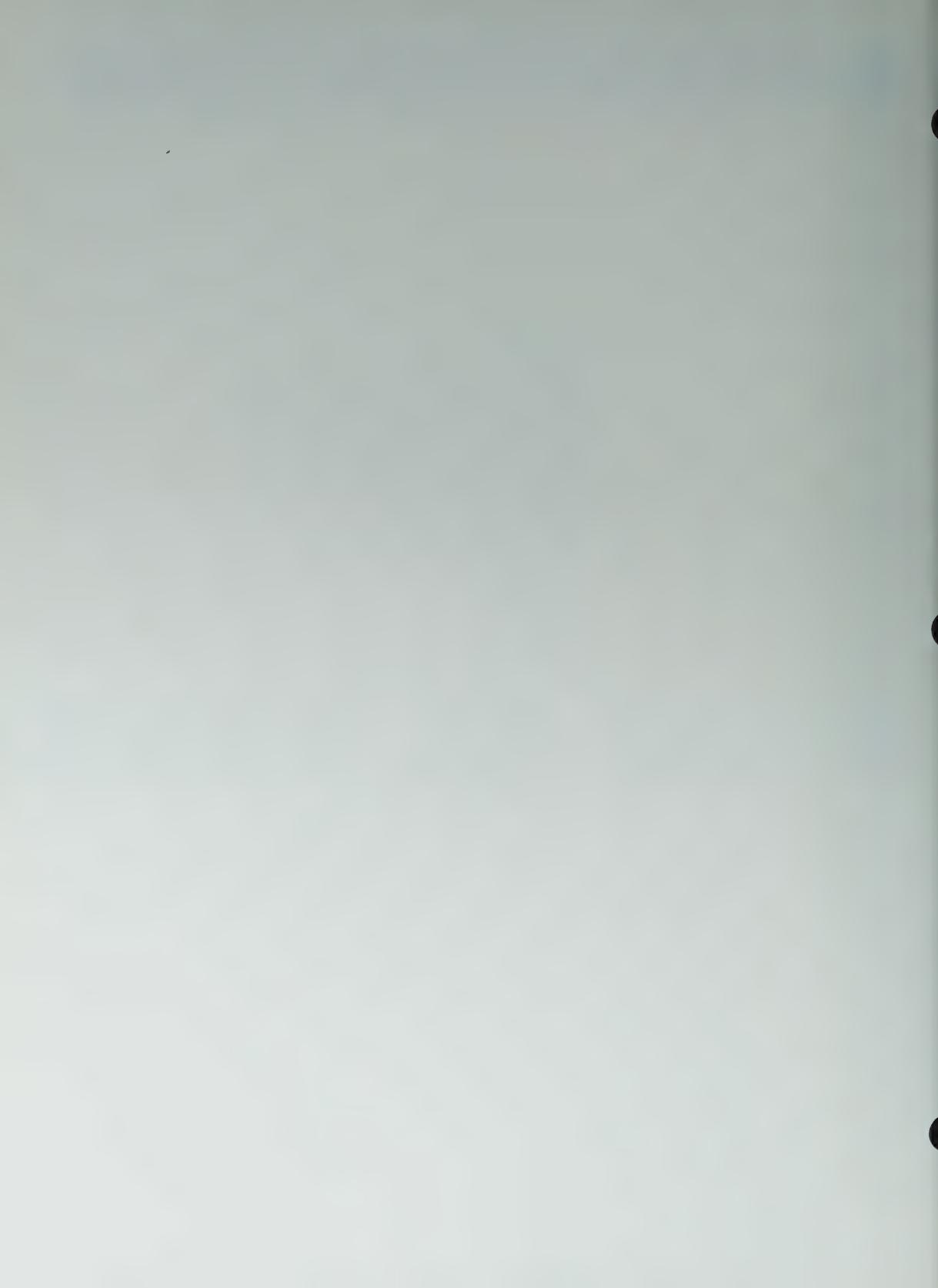
**MIL-F-15733**

**MIL-F-28861**

This section of the catalog is devoted to military specifications—MIL-F-15733 and MIL-F-28861 and their associated qualified product listings (QPL). The Locator pages will help you find the location of the QPL slash sheets in each catalog section and the QPL Listing pages document those slash sheets and dash numbers to which AVX Filters is already qualified.

- Analysis—MIL-F-15733 vs MIL-F-28861
- MIL-F-15733
  - Locator
  - QPL Listing
- MIL-F-28861
  - Locator
  - QPL Listing







# MILITARY QUALIFIED PRODUCTS

There have been many questions raised regarding the differences between MIL-F-15733 and MIL-F-28861. To clarify these differences we have incorporated the following Analysis Chart which compares the differences between these two military specifications.

ANALYSIS MIL-F-15733 vs MIL-F-28861			
	MIL-F-15733	MIL-F-28861	
Characteristics	Filter Design/ Construction	Filter/Design/Construction	
		Class B	Class S
CASE	Standard	Standard	Standard
CAPACITOR (Discoidal)	Standard	Special Design	Special Design
• Dielectrics	X7R, Z5U	BR	BX
• K	2200-10K	2K max	2K max
• VTL	N/A	+15%, -40%	+15%, -25% (when design permits)
• Cap Range	Max Cap/Case Size	Limited Cap/Case Size Conservation Design	Limited Cap/Case Size & MIL-C-123 Req'ts Conservation Design
Testing		Testing	
GROUP A	MIL-STD-105, 1.0% AQL	100% Test	100% Test
• Test	None	10%	Thermal Shock, Burn-in*, IR & DWV—2% each test
• PDA (parts defective allowed)			Cap, Volt. Drop, Insertion Loss $\leq$ 3% max combined
			Total 10% max
X-RAY	None	MIL-STD-202 Method 209	MIL-STD-202 Method 209
LEAK TEST	Condition "A" Gross Leak	Condition "A" Gross Leak PDA 10% max	Condition "A" Gross Leak Condition "C" Fine Leak PDA 10% max
BURN-IN	None generally. A few slash sheets require 1.4 $\times$ rated voltage	160 Hrs. @ 2 $\times$ rated voltage—Resistor protected	168 Hrs. (250 Hrs. max) @ 2 $\times$ rated voltage—Fuse protected *PDA .2% max last 50 hrs
INSERTION LOSS	1.0% AQL	100%	100%
SOLDERABILITY	None	MIL-STD-202 Method 208 5 Samples	MIL-STD-202 Method 208 5 Samples



## LOCATOR—MIL-F-15733 EQUIVALENTS

SLASH SHEETS	AVX FILTERS STYLE/SERIES
	CYLINDRICAL STYLE
70	GK Series
59	GK Series
38	BK & GK Series
49	BK & GK Series
58	CK & GK Series
24	GK Series
23	GK Series
39	GK Series
25	GK Series
34	GK Series
26	GK Series
	BOLT STYLE
28	SB Series
61	SB Series

NOTE — See QPL Listings for AVX Filters qualified product. Although equivalent dash numbers are indicated in the catalog, many of these have slight dimensional differences from MIL-F-15733.



## QPL LISTING—MIL-F-15733

SLASH SHEETS	DASH #
23	0001, 0002, 0003, 0004, 0005, 0006, 0013, 0014, 0015, 0016, 0017, 0018, 0025, 0026, 0027, 0028, 0029, 0030, 0037, 0038, 0039, 0040, 0041, 0042, 0049, 0050, 0051, 0052, 0053, 0054
25	0001, 0002, 0003, 0004, 0005, 0006, 0008, 0009, 0010, 0011, 0013, 0014, 0015, 0016, 0017, 0018, 0020, 0021, 0022, 0023
26	0001, 0002, 0003, 0004, 0005, 0006, 0008, 0009, 0010, 0011, 0013, 0014, 0015, 0016, 0017, 0018, 0019, 0021, 0022, 0023
34	0014, 0015, 0019, 0023, 0025, 0026, 0027

PART MARKING—  
AN IMPORTANT NOTE

All QPL MIL-F-15733 filters will be JAN marked. The standard catalog part numbers furnished to MIL-F-15733 will be marked with AVX Filters part number or as required by SCD or customer purchase order.



## LOCATOR—MIL-F-28861 EQUIVALENTS

SLASH SHEETS	AVX FILTERS STYLE/SERIES
	CYLINDRICAL STYLE
1	BK Series
2	GK Series
3	GK Series
4	HK Series
5	GK Series
	BOLT STYLE
6	SA Series
7	SB Series
8	—
9	SP Series
10	SN Series
	SOLDER-IN STYLE
12	ZS Series
13	WS Series
14	XS Series
15	YS Series
	CYLINDRICAL STYLE
16	JD Series
17	JD Series

NOTE — See QPL Listings for AVX Filters qualified product.



## QPL LISTING—MIL-F-28861

SLASH SHEETS	DASH #
1	003, 004, 005, 006, 009, 010, 013, 014, 015, 016, 019, 020
2	001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024
4	001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024, 025, 026, 027, 028, 029, 030, 031, 032, 033, 034, 035, 036
5	001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024

**PART MARKING —  
AN IMPORTANT NOTE**

All QPL MIL-F-28861 filters will be JAN marked. The standard catalog part numbers furnished to Class S and Class B reliability codes will always be designed and screened to the specified level and will be marked with the AVX Filters part number or as required by the SCD or customer purchase order.



# ADVANCED TECHNOLOGY FILTERS

- Advanced Technology Filters
  - Miniature High Temperature Solder-Ins
  - Hermetic High Temperature Solder-Ins
  - Aluminum Compatible Solder-Ins
  - Transient Voltage Suppressors







# MINIATURE (.100 Diameter) HIGH TEMPERATURE SOLDER-IN

## GENERAL DESCRIPTION

AVX now offers the popular high frequency space saving solder-in design in a .100 diameter version, a reduction from AVX's previous smallest version (.118 dia.), and smaller than the widely used .128 diameter. Although, there is some limitation on capacitance, it does provide effective filtering in the microwave frequency spectrum from 100 MHz to 26 GHz. Designed to be soldered into a package, bracket, or bulkhead providing package hermeticity, it's ideal where space and/or package weight is at a premium.

The .100 diameter version can be incorporated in either the **ALUMINUM COMPATIBLE** design or the **HERMETIC** version, capable of 400°C installation, or both, providing the ultimate in a rugged, miniature, environmentally stable solder-in style filter.

## FEATURES

- .100" diameter
- 300°C installation
- Hermetic seal one end
- MIL-C-123 discoidal available
- Gold finish standard, solder coat available

## STYLE

- Available in both standard and reverse configuration
- Available in both standard and custom feed-thru housings
- Available in **ALUMINUM COMPATIBLE** designs
- Available in **HERMETIC** version, capable of 400°C installation



## SPECIFICATIONS

- Operating temperature range: -55°C to +125°C
- Voltage rating: 50, 100, 200 VDC
- Temperature coefficient: NPO, X7R
- Capacitance Range: 10 pF to 10,000 pF
- DF: NPO - 0.1%; X7R - 3.0%
- Current rating: 5 amp DC
- DCR: .02 ohms



## SPACE COMPATIBLE SOLDER-IN

### GENERAL DESCRIPTION

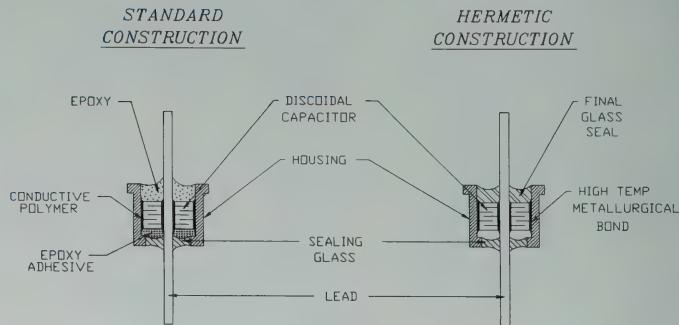
These are high frequency filters in space saving solder-in designs which will operate under harsh environments and meet the high reliability requirements of MIL-F-28861 without outgassing. AVX Filters Corporation has designed a filter which sets a new standard for the industry. These feed-thru filters are constructed with hi-rel semiconductor materials and rugged MLC discoidal capacitors. They are also manufactured at high temperatures ( $>500^{\circ}\text{C}$ ) without fluxes, epoxies or other polymers, thus eliminating failure mechanisms associated with conventional solder-ins. These solder-ins withstand short temperature excursions as high as  $400^{\circ}\text{C}$ , and can actually be operated at temperatures to  $200^{\circ}\text{C}$ . Available either as discrete packages in standard case sizes or as multiple filter brackets, all have hermetic glass-to-metal seals on both ends.

8  
2

### FEATURES

- Standard sizes
- Epoxy free construction
- Hermetic on both ends
- MIL-C-123 Discoidal Capacitor
- $400^{\circ}\text{C}$  installation

### AVX Filters Solder-In Style Filter



### STYLE

- Discrete, hermetically sealed solder-in filters
- AVX Filters Series:  
 WQ: .400" Case Diameter  
 XQ: .250" Case Diameter  
 YQ: .165" Case Diameter  
 ZQ: .128" Case Diameter  
\*Equivalent to MIL-F-28861 Series FS70, FS71, FS72, FS73, and FS74
- Custom design available
- Multiple filter arrays
  - Custom bracket housing employing discrete hermetic filters
  - Custom rugged bracket housings with inter-rated hermetic filtered feed-thrus

### CHARACTERISTICS

- Rugged monolithic ceramic capacitor construction
- Capacitor attached with solderless, fluxless, high temperature metallurgical bond
- Hermetic glass to metal seals on both ends
- No epoxies, resins or polymers to outgas or degrade in harsh environments

### SPECIFICATIONS

- Operating temperature range:  $-55^{\circ}\text{C}$  to  $200^{\circ}\text{C}$
- $400^{\circ}\text{C}$  rated installation temperature
- Voltage range: 50 to 300VDC/up to 200 VAC
- Capacitance range: 10 pF to 1.4 mF
- Hermeticity:  $1 \times 10^{-7}$  ATM  $\text{cm}^3/\text{sec}$  minimum
- Rated current: up to 25 amps
- Circuits: C
- Designed to meet or exceed requirements of MIL-F-28861



# ALUMINUM COMPATIBLE SOLDER-INS

## GENERAL DESCRIPTION

Manufacturers of hermetically sealed products have wrestled for years with the solution of effective sealing of feedthrus in aluminum housings and other high expansion metals. A recent case design breakthrough makes it possible to achieve highly reliable hermetic feedthrus in aluminum housings for severe military temperature environments. These filters installed in aluminum housings consistently passed hermeticity testing after hundreds of cycles.

## FEATURES

- Improved fatigue life of soldered seal
- Self locating feature for concentricity
- Optimum design for effective capillary solder flow
- Unobscured inspectability of solder joint
- Available in HERMETIC HIGH TEMP version

## STYLE

- Equivalent to MIL-F-28861/12, /13, /14, /15\*

WS/WR: .400" Case Diameter

XS/XR: .250" Case Diameter

YS/YR: .165" Case Diameter

ZS/ZR: .128" Case Diameter

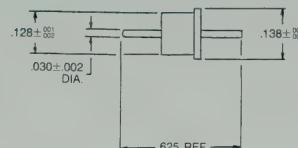
ZZ: .118" Case Diameter

\*Tolerances and flange dimensions differ

## APPLICATIONS

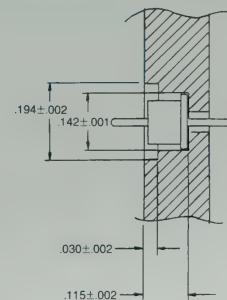
- Equally effective for use with metals of diverse of expansion coefficients, such as brass and Kovar
- Ideal for custom filter arrays, assemblies and brackets

Typical Dimensions  
for ZS/ZR Series



Patented Design

Typical Installation



## SPECIFICATIONS

- Circuits: C and L (C only for ZZ)
- Voltage range: 50 to 400VDC/125 VAC
- Capacitance range: 10 pF to 1.4 mF
- Operating Temperature: -55°C to 125°C, also available to 200°C
- Rated current: to 20 amps

## CHARACTERISTICS

- Effective filtering at 1 MHz and above
- High temperature construction withstands up to 300°C installation temperature
- Glass to metal seal on either end
- Rugged multi-layer ceramic construction
- Designed, manufactured, and tested to the requirements of MIL-F-28861



# TRANSIENT VOLTAGE SUPPRESSORS

As electronic systems become more sophisticated and make use of newer high density integrated circuits, their vulnerability to transients increases. These transients can vary from a few microseconds to several milliseconds duration and up to 10,000 volts.

As a result of this, today's electronic systems must be able to withstand a series of tests, such as those defined in MIL-STD-461C and similar documents, that stimulate transients caused by inductive switching, lightning, electrostatic discharge, and EMP.

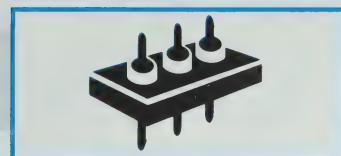
Taking advantage of our packaging expertise, AVX Filters can incorporate transient voltage protection in our ZS/ZR, YS/YR, XS/XR, WS/WR Solder-In Style; our GK and JD Cylindrical Style; as well as Multicircuit and selected Bolt Style EMI filters. Transient protection can be in the form of the newly developed AVX TransGuard™, MOVs, or back-to-back zener diodes.

The AVX Filters Application Engineering department is available to analyze your individual requirements, make recommendations and aid in finding the appropriate solution.

# MULTI-COMPONENT FILTER BRACKETS

## Multi-Component Filter Brackets

- Design
- Manufacture
- Testing







# MULTI-COMPONENT FILTER BRACKETS

## CUSTOM DESIGNED FILTER BRACKETS

AVX solder-in style filters are designed to be soldered into bulkheads, plates, and/or assemblies similar to those depicted in the photograph below. AVX Filters will design and fabricate bracket arrays to your specific requirements or Source Control Drawing.

The mechanical stress and extreme temperatures encountered by the filters during installation into assemblies is normally the harshest environment they will experience during the life of a system.

If you are buying the discrete filters and doing the installation in house you should seriously consider:

- How much is it costing you to purchase burned-in and fully tested filters only to damage them during the installation procedure?

- How much is it costing you to test for component integrity after installation?
- How much is it costing you to rework damaged filter assemblies at your labor rates and overhead?
- How much is it costing you to contend with low assembly yields?
- How much is it costing you to inventory a larger number of line items than necessary?

AVX Filters will design and fabricate filter brackets:

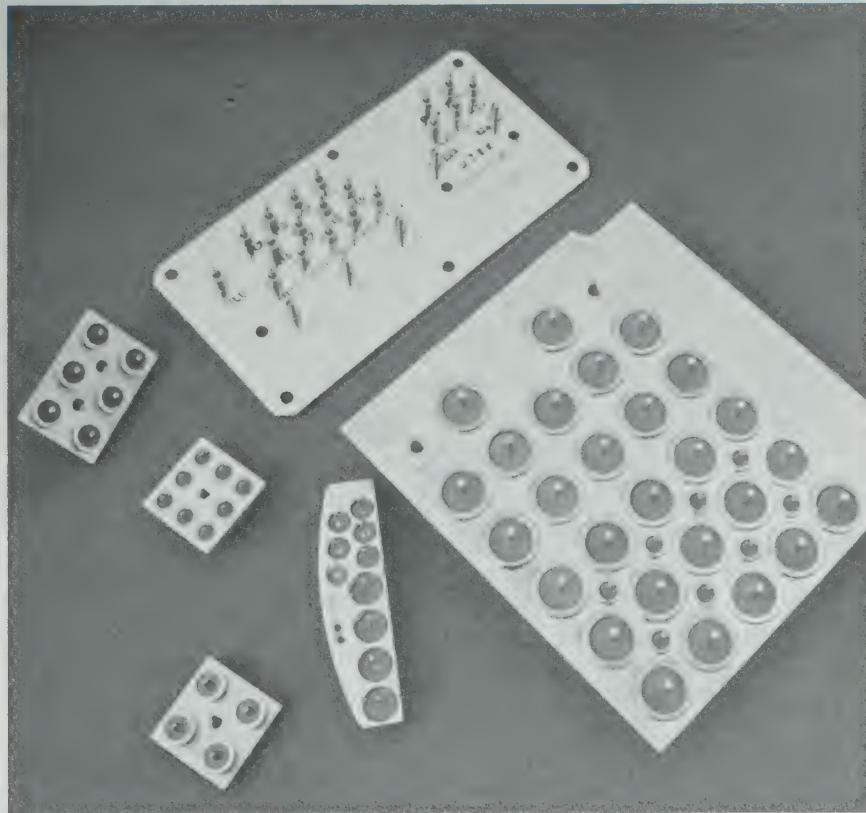
- To your specific requirements.
- 100% tested and burned-in prior to delivery.
- Which utilize the superior solder-in style filters (Series ZZ, ZS, XS, WS) capable of withstanding installation temperatures up to 300°C, or

- Which utilize the new hermetic solder-in when harsh environments or other requirements call for true hermetic components.

A custom designed filter brackets will help:

- To reduce your yield losses.
- To eliminate filter rework in assemblies.
- To reduce system assembly costs.
- To minimize your inventory.

For additional information on filter brackets or design assistance, contact the AVX Filters Application Engineering Department.





# MULTI-COMPONENT FILTER BRACKETS

## SPECIFICATIONS AND CAPABILITIES

### SIZE:

Basically unlimited. The physical size is determined by the quantity and style (WS, YS, etc.) of filters selected.

### CONSTRUCTION:

Hand fabricated or machined metallic (steel, brass, aluminum, or other alloys) bracket.

### FINISH OPTIONS:

The bracket can be electro-tin plated, gold plated, anodized, chem film, painted, or as specified by the customer.

The individual filter terminals can be gold plated or solder coated.

### ELECTRICAL CHARACTERISTICS:

The following electrical parameters are governed by the individual types of filters selected or as dictated by the customer's Source Control Drawing or specific application.

- Voltage Rating
- Current Rating
- Insulation Resistance
- DWV
- DC Resistance
- Insertion Loss
- Operating Temperature

### DISCRETE COMPONENTS:

The number of components, individual circuits, can range from 2 to 200 filters of different styles and/or electrical characteristics (WS, YS, etc.) and can be combined to form a single custom assembly.

### DISCRETE COMPONENT

#### TESTING:

QPL and/or QPL equivalents can be utilized.

Discoidal capacitors can be designed and tested to the requirements of MIL-C-123.

The individual filters can be specified with MIL-F-15733, AVX Filters Level R, MIL-F-28861 Class B or Class S reliability levels (see Reliability section of catalog for description) or as dictated by the customer's Source Control Drawing or specific application.

### BRACKET ASSEMBLY:

The completed bracket assembly can be tested to similar requirements as the individual filters.

### HERMETICITY:

Some brackets are more cost effective and volumetrically efficient as non-hermetic assemblies where application allows.

Most brackets can be manufactured to provide a hermetic barrier (glass to metal seal) on one side of the assembly.

There are true hermetic brackets, glass to metal seals on both sides, available, but only in a capacitive circuit.

### INSTALLATION TEMPERATURE:

Filter bracket assemblies are capable of withstanding installation temperatures up to 300°C.

### ADDITIONAL ASSEMBLY OPERATIONS:

Wiring harnesses or flex cables can be attached to the completed assembly and completely tested prior to delivery.

### ENVIRONMENTAL CONSIDERATIONS:

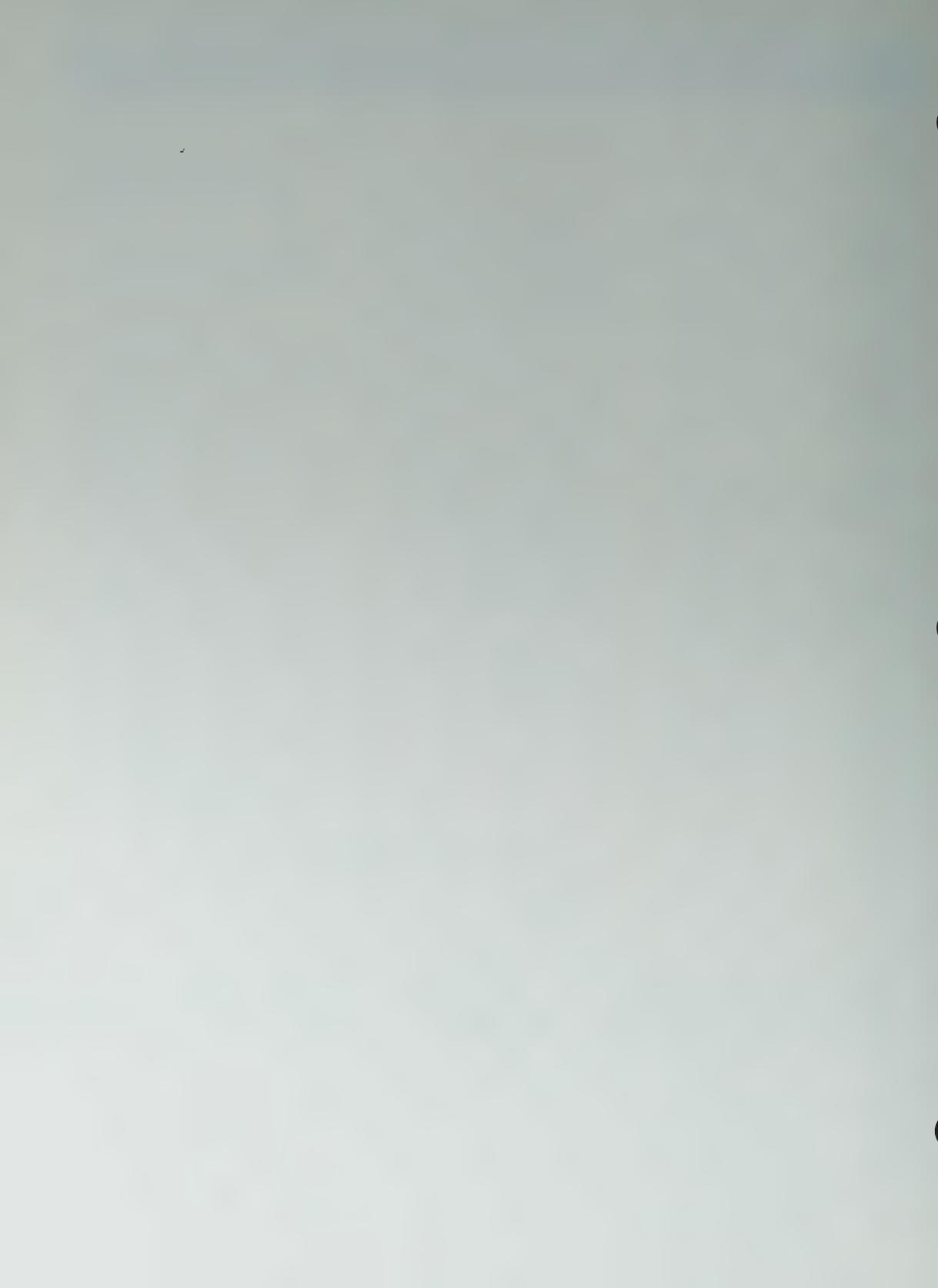
Capable of meeting the applicable portions of MIL-STD-202 and MIL-STD-810.

# CUSTOM DESIGNED MULTICIRCUIT

## Custom Designed Multicircuit Filters

- Design
- Manufacture
- Testing





# CUSTOM DESIGNED MULTICIRCUIT

## CUSTOM DESIGNED MULTICIRCUIT FILTERS

AVX Filters is a recognized leader in the design and manufacture of complex circuit designs utilizing high density component packaging technology to create multicircuit filters. Our extensive in-house capabilities include computer aided design, a prototype lab, and extensive environmental and electrical test facilities.

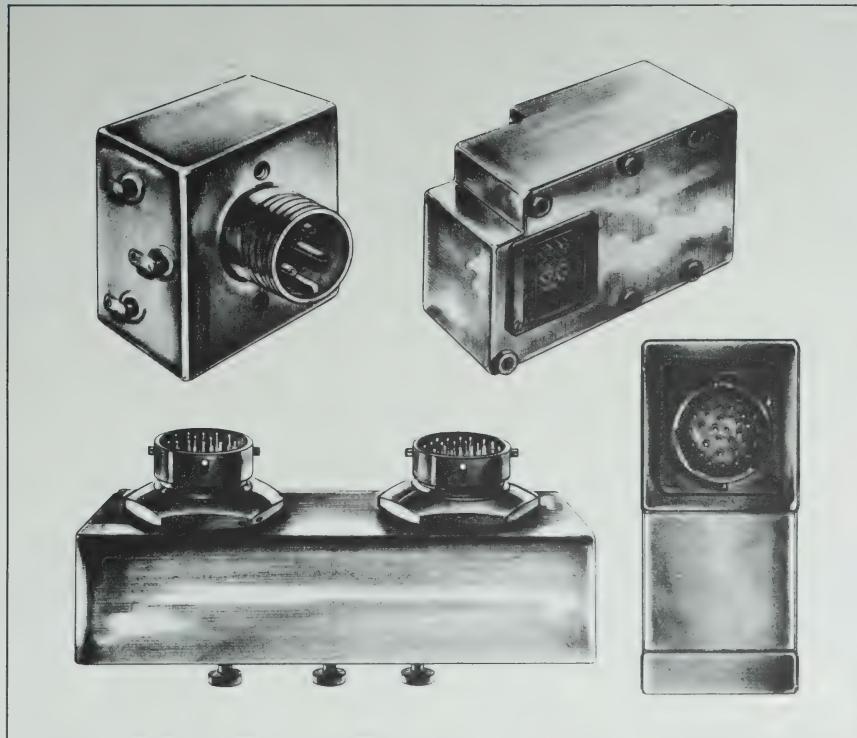
The AVX Filters Applications Engineering department is available to analyze your individual system or component problems, offer alternative solutions, make recommendations, and aid in the development of a Source Control Drawing unique to your specific needs.

The custom multicircuit filter designs incorporate the same high reliability processes and component construction developed by AVX Filters for their standard high-reliability military product lines. Each new design is prototyped and then extensively tested to verify performance prior to being released to production.

The internal components utilized in the filter assemblies can be specified with MIL-F-15733, AVX Filters Level R, MIL-F-28861 Class B or Class S reliability levels (see Reliability section of catalog for description) or as dictated by the customer's Source Control Drawing or specific application.

Multicircuit filters may also be designed to utilize QPL listed components to enhance their military customer acceptability.

Total in-house capability, years of filter experience, an in-depth knowledge of current EMI/EMC specifications, and extensive technical support makes AVX Filters the obvious choice for your custom multicircuit filter requirements. If you are confronted with unique space or weight constraints, or severe environmental conditions and a custom engineered and designed filter package is the option of choice, contact the AVX Filters Applications Engineering Team for the logical solution.



# CUSTOM DESIGNED MULTICIRCUIT

## SPECIFICATIONS AND CAPABILITIES

### SIZE:

Basically unlimited. Physical size is determined by the quantity and types of circuits, voltage rating, and current rating.

### CONSTRUCTION:

Hand fabricated, drawn, or machined metallic (steel, brass, aluminum, or other alloys) housing.

Hermetically sealed or non-hermetically sealed depending on the type of input and output terminations selected.

High density packaging containing up to 300 circuits.

Capable of incorporating unique mounting schemes utilizing brackets, connectors, threaded studs, aircraft fasteners, or blind inserts.

### FINISH OPTIONS:

Electro-tin plated, gold plated, anodized, chem film, painted, or as specified by the customer.

### INPUT/OUTPUT TERMINATIONS:

Military or commercial connectors, wires, solder terminals, screw terminals, flex cables or any combination.

### CIRCUIT TYPES:

Typical circuits include C, L, T, PI, 2T, 2PI, or any combination for specific common mode (line to ground), differential mode (line to line), pass band, and reject band requirements.

### CIRCUIT PROTECTION:

Lightning, EMP, and transient protection can be provided utilizing MOVs, spark arrestors, and bipolar transient suppressors.

### OTHER COMPONENTS:

Non-filtering components such as discharge resistors, switches, fuses, receptacles, relays, flex cables, wiring harnesses, etc. can be incorporated.

### VOLTAGE RATINGS:

The multicircuit filter assembly can contain individual circuits rated up to 1000 VDC, and/or 125/230 VAC, 50 Hz to 400 Hz, or any combination.

### CURRENT RATINGS:

The continuous operating current for the individual circuits can be rated up to 30 amperes, AC or DC.

### OPERATING TEMPERATURE:

Typically -55°C to +125°C or as dictated by the customer and/or the internal components.

### INSERTION LOSS:

Effective filtering from 100 Hz to 10 GHz as specified by the customer, measured in accordance with MIL-STD-220 (no load and full load), or MIL-STD-461 Current Injection Mode.

### OTHER ELECTRICAL SPECIFICATIONS:

Other electrical requirements such as:

Insulation Resistance  
DWV  
DC Resistance

are determined by the customer and/or the internal components.

### ELECTROMAGNETIC COMPATIBILITY:

Engineered and designed for system compliance to MIL-STD-461 Conducted Emissions and Conducted Susceptibility, or similar EMI/EMC specifications.

### ENVIRONMENTAL CONSIDERATIONS:

Capable of meeting the applicable portions of MIL-STD-202 and MIL-STD-810.

# HOW TO ORDER

- How to Order**
  - Notes
  - P/N Construction





# HOW TO ORDER

## NOTES

### Note 1: Capacitance Code

All AVX Filters part numbers, with exception of certain cylindrical styles, show total filter capacitance using the 3-digit EIA code. The first two digits are significant; the last digit is the multiplier.

Example: 103 10000 picofarads  
125 1200000 picofarads  
(1.2 microfarads)

It is important to note that  $\pi$  filters and multisection filters are described using the EIA code from the standpoint of total capacitance. Capacitance is understood to be specified as "guaranteed minimum value" (GMV) unless otherwise specified. AVX Filters can supply 20% or other specified tolerances at an additional charge. Contact AVX Filters Applications Engineering for further information.

### Note 2: Reliability Codes

The customer must select the reliability code to be consistent with the filter application. As a minimum, all catalog filters are available as R-level designs.

Options:

"—" signifies an R-level filter design without the optional R-level high-rel screening

"R" R-level design with optional R-level screening also specified

"B" Class B design with Group A screening per M28861 for Class B filters

"S" Class S design with Group A screening per M28861 for Class S (space grade) filters

Please refer to the catalog section on Reliability for additional information on how to select reliability codes.

### Note 3: Special Design Code (Assigned by AVX Filters)

A special suffix to the standard part number will be added by AVX Filters Applications Engineering to describe special designs or designs that are controlled by customer specifications. It is important to note that even in those instances where a customer drawing describes a standard catalog design it is AVX Filters policy to assign a special part number to the customer drawing for configuration control.

### Note 4: Reliability Codes for Discoidal Feedthru

The reliability code designations for discoidal feedthru capacitors are as follows:

"R" R-level design is specified without optional high-rel screening

"B" Class B design is specified without optional high-rel screening

"S" Class S design is specified together with high-rel screening and in-process inspections as specified for capacitor elements used in M28861 Class S filter designs

Please contact AVX Filters Applications Engineering to discuss your special requirements for in-process inspection and high reliability testing for discoidal capacitors. R-level and Class B designs can be supplied with optional screening if requested by purchase order.

### Note 5: Voltage Codes and Filter Voltage Ratings

**IMPORTANT:** please contact AVX Filters Applications Engineering when considering DC-rated filter designs for possible use in AC applications. As a general rule,

DC designs may be derated for AC applications. Let us assist you.

The voltage code letters must be selected consistent with the capabilities as outlined in the product selection tables for a given filter type. It is important to note that the same code letter may signify a different voltage rating depending upon filter type. For example: the "L" code signifies a 200 VDC/ 125 VAC rating for a bolt-style filter, but it describes a 300 VDC/ 125 VAC design when applied to a JD-style filter.

### Note 6: Terminal and Lead-wire Codes

Non-standard terminal configurations including special materials or finishes are available. Please indicate a description and/or outline drawing when requesting a non-standard terminal (code "3").

### Note 7: Special Information for Cylindrical Style Filters

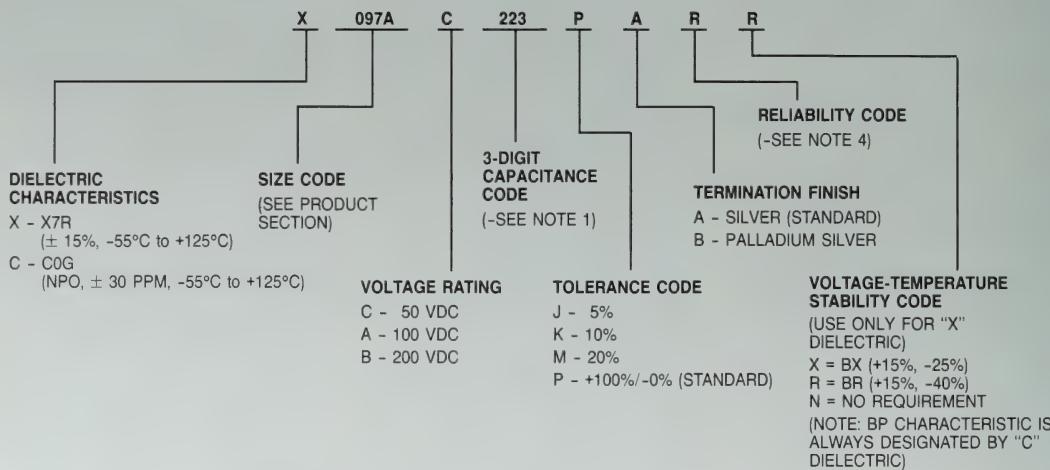
L-section filter designs must be specified with regard to "standard" or "reverse" configuration. The L-section filter is normally utilized with the capacitor on the high impedance side of the circuit and the inductor looking into the low impedance side. Compact filter types such as the BK2 or CK2 button filters with ferrite bead inductors are only supplied with the bead assembled into the threaded end. GK2 and JD2 L-section filters are normally supplied with a schematic or other marking to indicate location of the inductor.

AC-rated catalog designs incorporate reduced values of capacitance to limit reactive current heating (and subsequent filter temperature rise) to safe levels. Do not specify a DC-rated filter with larger capacitance for an AC application without contacting AVX Filters Applications Engineering.

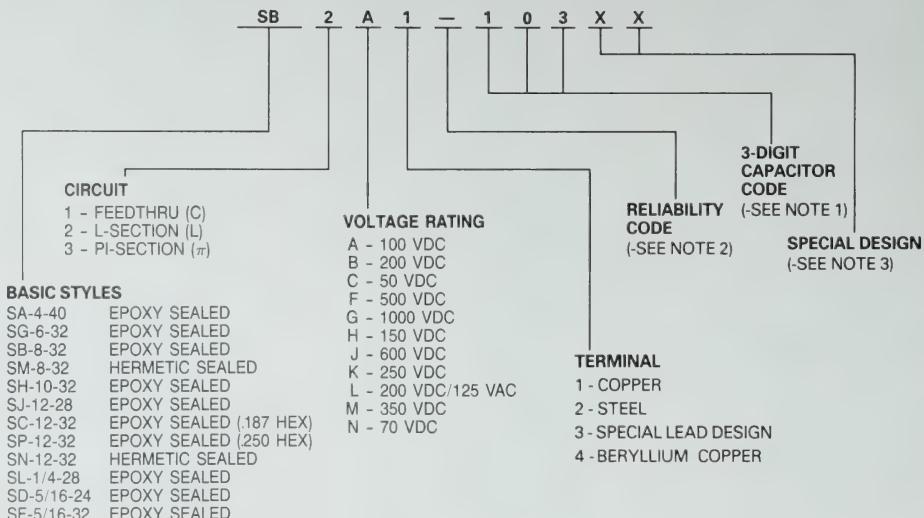
# HOW TO ORDER

## PART NUMBER CONSTRUCTION

### DISCOIDAL FEEDTHRU STYLE



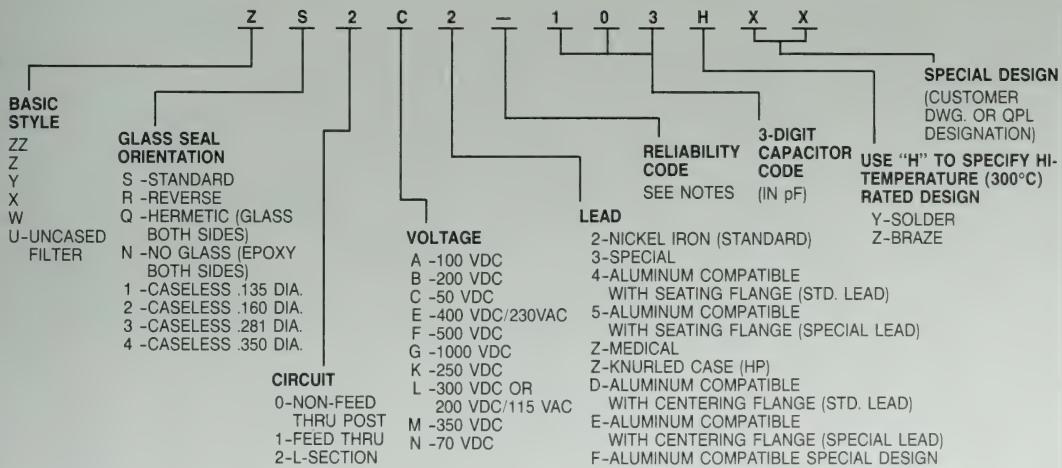
### BOLT STYLE



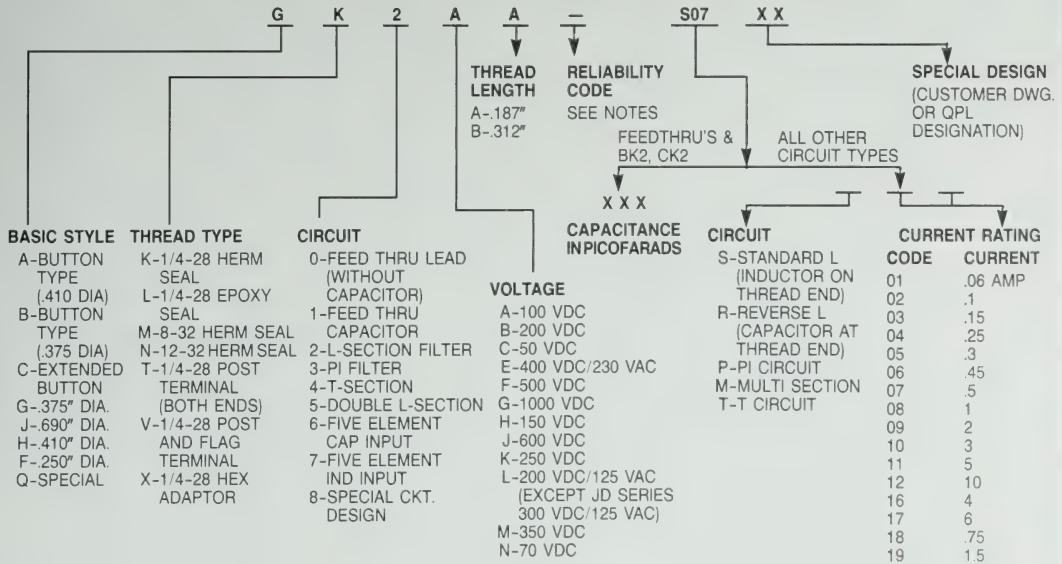
# HOW TO ORDER

## PART NUMBER CONSTRUCTION

### SOLDER-IN STYLE



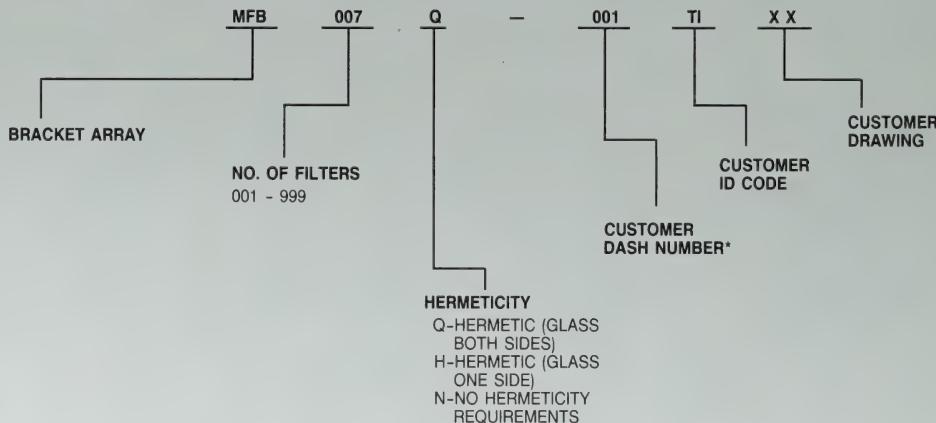
### CYLINDRICAL STYLE



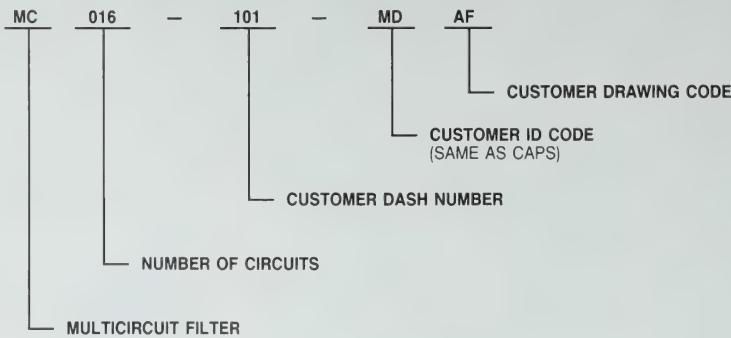
# HOW TO ORDER

## PART NUMBER CONSTRUCTION

### MULTI-COMPONENT FILTER BRACKET STYLE



### MULTICIRCUIT STYLE



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